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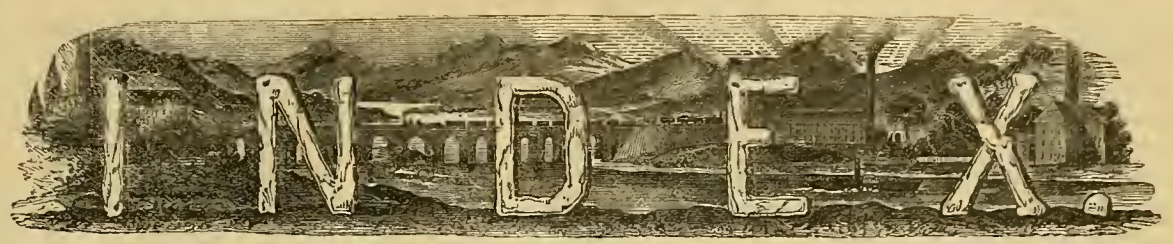

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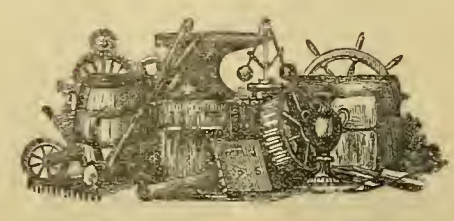

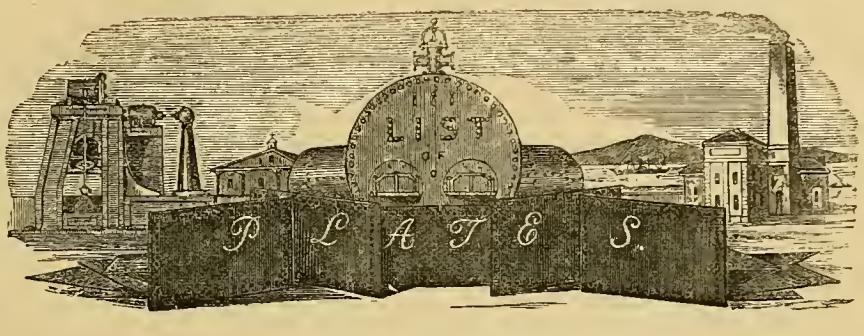

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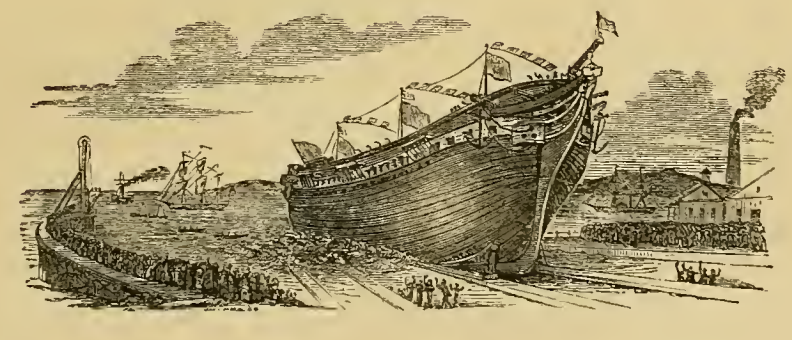


THE

PRACTICAL MECHANIC'S JOURNAL.

"Every new phase in our existence brings new responsibilities, and entails a constant and growing necessity for extended knowledge; and provided we are desirous of making ourselves useful in our day and generation, we must labour, first, in the acquisition of knowledge, secondly, in its application to the purposes of every-day life, and lastly, we must constantly strive to attain a life of spotless integrity."—FAIRBAIRN.

"In the history of mechanical art two modes of progress may be distinguished—the empirical and the scientific, not the practical and the theoretic, for that distinction is fallacious: all real progress in mechanical art, whether theoretical or not, must be practical. The true distinction is this—that the empirical mode of progress is purely and simply practical; the scientific mode of progress is at once practical and theoretic."—RANKINE.

MUZZLE SWIVELLING GUN MOUNTING.

In our Parts for December, 1861, and February last, we have given Mr R. Mallet's two memoirs, laid before the authorities, descriptive of his primary idea, and various methods in detail, for carrying out the training or aiming all ordnance, in any direction, by two independent radial motions, one in the vertical, the other in the horizontal plane, and both centred at a point close to the muzzle of the gun—the object in view being to reduce the necessary openings of the embrasure (or ship's port, if a naval gun,) to the least possible dimensions—to a size greatly less than is possible while the gun, as in all existing mounting, traverses horizontally only, around a point near the muzzle, but is elevated or depressed around another point (the trunnions) situated in rere of its mid-length. This must constitute an improvement, undoubtedly of the very highest importance, whenever it shall be practically carried out in a perfect way; for this, no higher authority need be demanded than the express declaration of Sir John Burgoyne, G.C.B., Inspector-General of Fortifications; and, whether Mr Mallet's concrete arrangements be good or bad, we think we may venture to predict that, either by these or by others, his primary idea of swivelling in all directions round the muzzle will be, ere very long, reduced to practice, and widely adopted. The enormous increase of safety, that it offers to the men working the gun, behind a circular aperture not as much as two feet in diameter, as compared with a rectangular one of, say, at the smallest, two feet wide by three and a half in height, or in relative area, as 3 to 7 square feet (the latter being less, we believe, than the area of the *Warrior's* ports), is, in these days of marksmanship, too important to be lost sight of, or set aside at all hastily, on the alleged ground of mechanical difficulties of construction. The problem as to practical detail of construction may not be, and we think is not, obviously simple; but it presents nothing that ingenuity and practical resource may not overcome.

Mr Mallet's proposed arrangements for thus mounting muzzle swivelling guns, and *also* working or training them by hydraulic power, i.e., mechanically, in place of by manual labour, is an entirely distinct and different proposed innovation, and one that artillery officers, at least, unfamiliar as they necessarily are with questions so much belonging to mechanical engineering, will very imperfectly appreciate, and, for a long time, be adverse to. Yet even this mechanical working of great guns, or some equivalent for it, we think, belongs to the future—though a more remote future, of artillery. Armour plating, applied already to war-ships, of a class larger than anything before known, and probably on the eve of being applied upon a vast scale, and in enormous thicknesses, as an iron facing for coast defence batteries, has already called forth a three hundred pounder Armstrong gun. As these means of defence become improved, magnified, and extended, still more enormous artillery must be produced to match the resistance. Guns as heavy, or, possibly, far heavier, than the well-known Mersey gun, but made on sounder principles, fitted to project orbs, or bolts, of five hundred, a thousand, or even two thousand pounds, will appear. These prodigious masses of material, *must* be trained, and moved, and arrested as accurately (for many purposes) as a 12-pounder Armstrong field-piece, and to be of any use against armour-plated steamships, endowed with versatile mobility, and a speed as great as many railway trains, these monster ordnance *must* be moveable with at least as much rapidity and ease as a 68-pounder. How is that to be done? Is it *possible* to be accomplished by manual labour alone—by the favourite methods of the old school of artillery—"the strength of men and handspikes;" we confess we do not think so. Whenever guns greatly heavier than the 68-pounder, or the 100-pounder Armstrong, shall come into use, we predict that the cannon must cease to be a "hand-tool," and become "a projectile engine," moved and manipulated by power of some sort, under the exact control of the directing artillerist.

We stated in our introductory remarks (Dec., 1861, and Feb, 1862) that Mr Mallet's memoirs, embracing these various improvements, were forwarded originally, in 1856, to Sir John Burgoyne, and deemed by him sufficiently important to be forwarded, in 1858 (after the receipt of some further communications from Mr Mallet), to General Peel, the then Minister of War, with a request that the subject should be considered fairly upon its merits, and an impartial report had. The subject was referred, according to the usual routine, to the Ordnance Select Committee at Woolwich, whose report, *verbatim*, we are enabled by Mr Mallet to subjoin. He has stated in our pages, and we must say, in a

quite unexaggerated way, what he deems the advantages or some of them, of his arrangements, and is candid enough now to give us what can be, or, at least, what has been said against them, in the following Report of the Select Committee. It is perhaps unfortunate for the inventor that two propositions, each distinct—1st, The muzzle swivelling, and 2d, The hydraulic mode of working—were both put together for report before the Committee; for we cannot but remark that the first, and, for the present, far more important improvement, appears to have engaged comparatively little of the attention of the Committee, whose objections to *it* are almost all confined to mere matters of detail, while their chief attention seems occupied with the more startling innovation of the hydraulic working. The remarks which follow this report are by Mr Mallet, in his own proper person, and we are not responsible for the statements or arguments. We have devoted a large space to this important subject, but, with the present article, must close it.—Ed.

1. New mode of mounting and elevating guns in casemates.

2. New mode of mounting guns in casemates, and working them by hydraulic power.

The advantages, or some of them, claimed for these arrangements are as follows:—

1st. Heavy guns may be manœuvred perfectly with a much smaller number of men than used.

2d. The power of rapidly swaying the gun in every direction; of instantly arresting its motion, and the power of *either rapid change of direction, or fire, and gradual adjustment of aim*, offer immense advantages to the rapidity, power, and concentration of fire from coast batteries upon shipping in rapid motion.

3d. This method of mounting is applicable to all natures of guns, and would be of the greatest advantage with a perfect "breech-loader." As time is saved as well as manual labour in every operation of handling the gun, so the fire from a gun, when thus mounted, may be much more rapid than ordinary with equal or greater exactness of aim.

4th. This method of mounting and handling guns by hydraulic power is susceptible of remarkable extensions. It is as easy and simple to sway and direct *every gun in a large battery, by one man, and acting upon one pair of valve levers at a single point*, as it is to lay any single gun; and there is not the slightest difficulty in arrangements such that an officer stationed at, and aiming at the *centre gun* of a whole range, shall automatically direct and aim all the others, and that the fire of the whole range of guns shall be necessarily and at his pleasure concentrated upon the same point at which he aims the centre gun.

5th. The cost of this method of mounting heavy guns, if largely adopted, would not exceed the common one, with dwarf traversing slides and platforms inclusive. The hydraulic machinery is of the very simplest character, and experience of its application now for years and upon a vast scale (extending in the case of the Victoria Docks to over four miles of pipes conveying the hydraulic power) has shown that it is not liable to derangement.

6th. The whole floor of the casemate and space round the gun is

(1.) Mr Mallet proposes a new form of gun carriage, which he states is applicable to guns of all present natures for garrison use. The peculiarity of this carriage is, that the gun elevates and depresses upon a horizontal pivot joint close to the muzzle, and directly over the point at which the traversing frame pivots horizontally. The recoil of the gun is transferred back from the trunnions through two side links of wrought iron or steel connected with the forward end of the gun carriage by a horizoutal pivot placed beneath the muzzle, and passed through a bracket bolted to the bed of the carriage, which is of wood. The muzzle of the gun is supported by a vertical wrought-iron link jointed at top and bottom to permit of the angular movements of the muzzle incident to the elevation of the gun.

The gun is supported from the outer ends of both trunnions by a pair of elevating screws of peculiar construction, one under each trunnion. The muzzle of the gun in the drawing is shown turned off to the form of Monk's pattern, to make it pass through a smaller aperture, but this Mr Mallet does not consider essential to the plan.

(2.) This arrangement of what is termed "muzzle swivelling," by means of pivots, etc., at the muzzle of the gun, to elevate and depress, appears very complicated, ill adapted for the intended purpose, and presents many serious objections.

(3.) The great aim has hitherto been to avoid having vital points unnecessarily exposed, but, by this system, in the event of a shot striking the muzzle, the pivots would be liable to disarrangement, and the gun and carriage rendered unserviceable. The method proposed for elevating and depressing the gun by using two elevating screws, or two "hydraulic jacks," attached to the trunnions, does not appear to be a good mechanical arrangement for effecting the object in view, as it is greatly deficient in all the qualifications of stability, simplicity, easy handling, and working.

(4.) The arrangement described for the action of *double* screws is not new, and its application to the elevation of guns is only to a certain extent so.

A double screw, or one screw within another as an elevating screw, has been tried; and one of this description can be seen in the royal carriage department.

Using screws *right* and *left* is common for other purposes.

by this method left free and unimpeded; there is nothing to trip up the men in the dark. No platform to injure them by splinters if struck, and the narrow traverse carriage presents the smallest possible "end on" mark for being struck.

(5.) According to the drawing, two persons would be required to work the screw, which is objectionable, and in the *heat* of action almost impracticable, as they could not be worked simultaneously, and in all probability would come to a jam.

The two screws being placed at the sides of the gun, they and the two men required to work them are much exposed.

The complication of the two screws is avoided by the *one screw* now in the service (Smith's elevating screw), in using which neither the man nor the screw are exposed to anything like the same extent, and, in most cases, the man who lays the gun can use the screw.

(6.) It appears very doubtful whether a gun (68-pounder) could be fired at 15° depression (as shown on the plan) with the arrangement of screws and pivots therein proposed without great liability of breaking the screws or pivots.

(7.) The construction of the proposed embrasure appears to be that of reverting to the old open one, forming a complete funnel for the reception of shot, which, with a parapet of only five feet thick (according to the plan), would give an exterior opening next the enemy of little less than eight feet, whereas the great object to be obtained is directly the reverse, viz., that of having the smallest amount of opening. This can be obtained by adopting the principle proposed by the late Colonel Colquhoun, viz., the inverted or Montalembert embrasure, by which the opening of the exterior front and throat are reduced to a minimum.

(8.) There must be sufficient opening in any embrasure to lay the gun with facility, and to allow the object fired at to be seen. There is, therefore, an objection to the proposition of making the opening *only a little* larger than the *muzzle of the gun*, as, if this were the case, it would not be possible to lay a gun point blank on an object, nor could a dispart sight be used.

(9.) The plan proposed of having the muzzle of the gun almost in a line with the interior opening of the embrasure would be attended with great inconvenience, as on the recoil of the gun a great part of the smoke would be carried into the casemate.

(10.) The sketch and model of the invented embrasure, proposed by the late Colonel Colquhoun, show that the neck or throat, and the exterior, have been reduced to such a minimum as is consistent with the space required for extreme horizontal pointing, and the height required, not only to fire point blank, but to enable 10° to be obtained, or little more than the diameter of the base ring, which must be duly considered in regulating the height of the casemate embrasure.

(11.) It was found, on trial with the inverted embrasure above mentioned, that from the muzzle of the gun projecting beyond the throat and exterior opening, when fired, that no smoke came into the embrasure (*casemate*).

Simplicity of construction to obtain the desired object is of great value and importance; and the committee are of opinion that this can be fully carried out, with little or no alteration of the system of the inverted embrasure, and with the present carriage and traversing platform on raised racers.

It was first proposed to reduce the swell of the muzzle of the gun, as shown in Colonel Colquhoun's model, but this was objected to by Admiral Chade, (on the part of the navy,) as there would be a difficulty in *housing*, from there being nothing to prevent the rope slipping off. Colonel Chalmer also considered that the gun might be too much weakened at the muzzle by the alteration. It was, therefore, finally agreed that, if considered necessary, the swell might be reduced, but not altogether, and a flat patch left on top for housing.

(12.) The platforms of the service would be too short for the proposed description of carriage (by five feet) to allow of recoil; and if the platform be increased in length, it would require more space in rear of the battery.

(13.) Mr Mallet also submitted to the committee a method of mounting a gun with the additional peculiarity of its being worked by hydraulic power.

The gun swivels in all directions about a centre close to its own muzzle, as in the other design, but is placed upon a wrought iron carriage, which is free to slide back or forwards upon the side cheeks of a wrought iron traverse frame. This traverse frame is pivotted close under the muzzle of the gun (when run forward), so as to be free to move in vertical or horizontal axis, or in both round the centre.

The rear extremity of the traverse frame is held suspended by two chains, which pass from its right and left to the sides and top part of the casemate, and are thence brought down over sheaves and connected with an hydraulic cylinder placed in a recess, so as to be out of reach of shot.

A supply of water at an adequate pressure being provided for these cylinders, (by the usual method of an accumulator, with a pump and small high-pressure engine to work it, all of which are to be placed under ground, in rear of the battery, so as to be secure), for the admission and emission of water, and hence the movement of the suspending chains are under the control of a single man, by the moving of two small valve handles, situated at the right rear of the gun.

(14.) In the scheme here proposed the traverse frame is pivotted close under the muzzle, is *three feet six inches in width*, and therefore the neck of the embrasure must necessarily be very nearly the same to admit of the gun being pointed to extreme pointing horizontally; and supposing the parapet to be five feet in thickness, the exterior opening (as shewn in the plan No. 2, E,) would be eleven feet, being, as stated with respect to plan No. 1, very objectionable, creating a complete funnel for the reception of shot, and from its size, forming a great mark or target at a considerable distance, which makes it in every respect inferior to Montalembert's, or the Inverted Embrasure of Colquhoun, which gives the smallest amount of opening in front, next the enemy, at a minimum under three feet, and only one foot eleven and a half inches at the throat.

(15.) The filling up of the embrasure with wood and iron, as shewn in these plans, presents a target or flat front of eight feet four inches in width, and eight feet six inches in height, with, as it were, an open bull's eye in the centre in front, of four feet diameter, with a smaller bull's eye of two feet ten inches diameter next the muzzle, this latter bull's eye being composed of sufficient thickness of iron, when shutters are closed, only to be proof against musketry.

(16.) The pivotting end of the traversing frame next the interior opening of the embrasure, and near the muzzle, is much exposed to the effect of heavy shot, and taking the diameter of gun, as shewn, at twelve inches, it would have a space of at least nine inches round the muzzle.

(17.) The largest and heaviest guns at present in the service are the 68 pr., 95 cwt., and 112 cwt., and the ten-inch gun of 87 cwt., and recent experiments have shewn that with the present traversing platforms, working on raised racers, that even with a common four-feet hand spike these heavy guns can be traversed with very great ease, and sufficiently quick to be directed on any vessel. Besides, in addition to the hand spike, the assistance of side tackle has been resorted to.

(18.) The great object hitherto has been to avoid unnecessary complication, when all that can be practically required is obtained by simple and inexpensive means, and for which reason it has not been hitherto deemed necessary to employ hydraulic power, which, although not proposed to be used in the same manner as that shewn by Mr Mallet, has already been under the consideration of the Committee as an agent for moving and manœuvring heavy guns, hydraulic power being extensively used in the Royal Arsenal for a great variety of operations, including the mounting and dismounting of heavy guns.

(19.) The committee are fully aware of its many advantages when applicable, but, at the same time, are of opinion that its application in the manner here indicated would be found not only impracticable as a mechanical arrangement to effect promptly the nice adjustments that are essential, but highly objectionable in many other respects.

(20.) It is unnecessary here to criticise Mr Mallet's arrangements for altering the position of the gun by means of the two handles, but if the Committee are to judge from the valve manipulation of existing hydraulic machinery, it will be found impossible to get the water to flow simultaneously into or out of the two cylinders, while to expect that the more complicated combination of movements necessary to effect the horizontal and vertical changes by the mere opening and closing of the respective valves, is so at variance with what it is believed would be the case, that the Committee have no hesitation in stating that it would be most unsatisfactory in its action, and entirely unreliable as a military appliance on actual service.

(21.) If it is deemed desirable to employ hydraulic power, there are many ways of doing it, which, in a mechanical point of view, will be more likely to effect the object; but here arises the question of the propriety of introducing into batteries such machinery, with high-pressure steam engines and boilers, as proposed by Mr Mallet, (which latter proposal is deemed inferior to one previously submitted to the committee, viz.:—of using a simple hand pump, with an accumulator placed under ground for the storage of men's power), which would be equally efficient, so far as mere power is concerned, and certainly more simple.

(22.) But taking into consideration the many chances of the whole hydraulic arrangement being thrown out of order by a single casualty, even when not struck by shot, thus rendering a whole battery (dependent on one set of hydraulic machinery,) unserviceable, it does not appear to the Committee that hydraulic power can at present be introduced with advantage for the purpose proposed.

The Committee, for the reasons above stated, do not recommend any experiments with reference to Mr Mallet's proposition.

(Signed,) J. CRAUFURD CAFFIN.

Remarks by Mr R. Mallet *upon the Report of the Ordnance Select Committee as to his Method of Muzzle Swivelling and Hydraulic Gun Mounting.*

A copy of this report, without date, was, after considerable difficulty, obtained by me from the late Lord, (then Mr Sydney) Herbert, Minister of War. It had been previously refused, on the usual stereotyped ground that "such reports were only for the information of the Minister of War," and was only at length granted, upon my representing that when inventions were objected to, all power of improvement by removing alleged objections was taken away from the inventor, if he continued to be denied all knowledge of the nature of the objections made. The copy was received by me on 10th September, 1859, about *three years* after the original matter was first brought forward by me.

I have numbered the paragraphs of the report, for reference, in the ensuing remarks. I believe I may state this as a general fact, "the custom of the department" is, with respect to every report of the Ordnance Select Committee, that the inventor's views are professedly given by culling out of his memoir or communication, a few leading propositions supposed to represent his views. Upon *these* the report makes its *objections*, but objections *only*. It would seem to be held that the function proper, to an Ordnance Select Committee report, is to "pick holes," to find fault, and that it is no part of its duty to weigh advantages with disadvantages, nor to take or suggest broad and sagacious views of the *principles* of improvement; and where the latter may be important and valuable, to say so distinctly, although, at the same time, it might be obliged to condemn the methods proposed for carrying them out. In such reports (so far as I have had any opportunity of judging) nothing seems ever to rise above mere detail, or carping at details, by objections real or imaginary, and the impression made is that the grand object of such a report is "handsomely to floor" the unhappy inventor, who always appears viewed as the natural antagonist of the reporter. No method of reporting can be more unfair, to inventions and inventors; none more certain to lead to error, to retard progress, or even, by possibility, to abuse of the truth.

In venturing to make these few general remarks, officially unpopular as they may be, I disclaim the slightest disrespect, or the least tincture of personal feeling or disappointment. Individually I have ever found every officer of the select committee, and of every department of the Arsenal at Woolwich, a *gentleman* in the best sense of the word; but that does not alter the vicious system, upon which action is taken upon all novelties or inventions submitted, or the evil results to the commonwealth that follow from it. I will only further venture to refer to some remarks on this subject, in the notes I and (conclusion of) Z in my work on "The principles involved in the construction of artillery."

The reader of the following remarks should refer to the numbered passages of the original report in each case.

No. 1. The report professes to treat of two inventions, viz.. 1. Muzzle Swivelling; 2. Hydraulic Working. It commences by giving statements supposed to represent the views of the memoir. These from 1 to 4, inclusive, (in the left-hand column), all refer to the second subject first, viz., Hydraulic Gun Mounting; but it will be seen that the remarks of the report (right-hand column), 1 to 2 inclusive, refer not to this at all, but to the Muzzle Swivelling, a rather curious instance of the confusion that prevails throughout the report, in which these two distinct things are mixed up with little order or exactitude.

2. Here are the first distinct propositions to which the report commits itself—"The arrangement of what is termed muzzle swivelling appears very complicated, ill-adapted for the intended purpose, and presents many serious objections." All these are highly condemnatory *phrases;* but they are merely vague accusations, unsustained by a single reason, or ground for the *dictum*. They don't present a single point to fix an answer upon—very damaging to the invention before a Minister of War or any other unpractical man, and ignorant of the facts; but, yet, "vox et prætærea nihil."

3. "In the event of a shot striking the muzzle, the pivot and gun carriage might be rendered unserviceable." This ignores altogether the fact that "vital points" are not exposed at all, for an essential part of the project is that the embrasure (except the one round hole) is completely stopped by shot-proof plates. How many ordinary mounted guns remain serviceable, after getting such a "facer" as a shot striking the muzzle; probably one in five hundred.

4. "The arrangement described for the action of double screws is not new, &c." I beg leave to reaffirm, that at the date, 1858, when I produced it, the arrangement described at p 229, December part of *Practical Mechanics Journal*, and figured in figs 12, 13, 14, and 15 was *perfectly new*, not only new as an application to ordnance, but a new application altogether of a right-hand screw in combination with a left-hand one; so completely new that it might alone have formed the subject of a patent applicable to many useful purposes besides ordnance, being, in fact, a converse modification of the celebrated "Hunter's screw," described in most books of elementary mechanism. And I now respectfully challenge any one at Woolwich to point out an example there or

elsewhere, at the above date, of any like combination, and producing the same effect, viz., an end-on movement, equal to the pitch of two threads, for each revolution of the one outer screw. The report says—"One screw within another as an elevating screw has been tried, and one of this description may be seen in the Royal Carriage Department" I believe there is no identity whatever, between the screw thus appealed to and mine; if so, this part of the report appears disingenuous. It adds—"Using screws right and left is common for other purposes." No doubt, and so "cylinders" and "separate vessels" were common for "other purposes" before Watt brought them together and constructed his condensing engine!

5. I expressly state that the two screws, if desired, may be combined so as to work together, by the hand of one man; my statement is suppressed, and upon its omission the whole objection under this head of the Report is unfairly constructed.

6. "It is doubtful whether a 68-pounder could be fired at 15° depression, with the arrangement, &c., without *liability* of breaking the screws or pivots." All parts of a system, subject to strain or impact, are *liable* to break; but preventing the liability becoming a reality, is simply a question of calculation of stress and strain. The strain in this case on the screws at 15° depression is very small, and, if desired, may be made nill; and the strain upon the pivots under the muzzle, (not attached to the gun but to the carriage,) is just equal to that on the gun trunnions, with the advantage of the pivots being wrought iron. The "pivots" are, therefore, no more taxable with this imaginary evil than the trunnions of a common-mounted 68-pounder, at equal depression.

7. All this objection is founded upon ignoring completely the fact that the *whole embrasure*, except the one round hole, is *stopped up by shot-proof plates*, and hence the bottom of "the funnel for the reception of shot" is just as impenetrable as any other part of the face of the work. The Report takes no notice anywhere of the greatly increased strength produced in the masonry of the rampart by the circular form of embrasure, by me proposed, and it states that "the smallest amount of opening" "can be obtained by adopting Colonel Colquhoun's embrasure." Now, in the first place, this is not a fact, for Colonel Colquhoun's embrasure was merely *narrow*, but still *as long as ever vertically;* but what will be thought of advancing such "a diversion" to serve as an argument, when I state that it is well known, and recognised by artillerists and military engineers, that Colonel Colquhoun's embrasure is "impracticable"—such was the word used to me of it in writing, by a distinguished officer and competent judge. I may add, that I was shown drawings of this same embrasure, upon occasion of my coming before the Select Committee, and I then pointed out to the officers present that it was impracticable, inasmuch as the stone at either jamb is necessarily so attenuated that even a four pound shot would knock away lumps of it from either side, and open it to the full width of a common one, if not to much more, with the "obligato" of showers of stone and splinters being driven inside.

8. Here the objection is taken to an opening that it is only a little larger than the gun muzzle. It is amusing to observe the conflict of objections here (8), and in 15 and 16, further on. The embrasure aperture is both too big and too little; but, if the latter *be* an objection, is it so *very* difficult to take off an inch or so from the iron stopping plates all round the muzzle apertures?

9. The muzzle of the gun can be run out some inches outside the *exterior* face of the embrasure, if stopped by a single plate. As to the smoke, the objection is that of the nature of that obfuscating material; in *every* casemated battery, and between decks, in every fighting ship, means should exist for constantly clearing away smoke by fan-blast, causing a constant current of air, *out* through the embrasures, and this no matter how the guns are mounted.

10 and 11.—I have disposed of Colonel Colquhoun's embrasure already. We have here again a few sage platitudes—"simplicity of construction to obtain the desired object is of great value and importance," &c. How is it that, since 1858, to this year of grace, 1862, none of these embrasures have been anywhere employed, that the Committee then say could do all I proposed?

12. One, if not more than one, of the designs for mounting exhibited by me were prepared expressly to suit "the service platform and racer," and were so by the advice of Sir Jno. F. Burgoyne.

The subsequent statements of the Report refer to the Hydraulic Gun Mounting.

13. Professes to describe the leading features of my arrangement; and in

14. The first objection is made. I must content myself with saying here that it is based, upon complete mistakes and misconceptions, of what is shown plainly enough on the original designs.

Space would not allow me to go into details.

15. Here, *ad captandam* use, is made of a number of phrases. The iron-stopped embrasure is "a target'—"an open bull's eye"—with "a smaller bull's eye in the centre," &c., &c. No doubt, and so in the whole side of the Warrior, a target, and every port with a protruded gun muzzle, is an open bull's eye, with a smaller bull's eye in the centre. Objections seem to have been scarce when this was penned.

16. See No. 8, and observe the conflict of opposite objections.

17. Most of this is beside the point. The real value of Hydraulic Gun Mounting, will only be fully developed, when guns get to a size (as they actually have done now in some cases,) that they *cannot* be handled by handspikes, and side tackles, and the like. But even with a 68-pounder in a coast battery, I may be permitted to doubt, that much time and labour is not always lost, in training between the rounds every second being precious when firing at a swift steam-ship passing or getting away; and to still think that by better arrangements, such as I have proposed, some seven shots for five might be given, with good aim in the same time.

18. When summoned before the Ordnance Select Committee, I was gravely informed that my plans for Hydraulic Gun Mounting had been anticipated, that an officer of one of the departments had laid similar plans before them. On pressing for information upon this unexpected point, I was informed that an officer (I need not name), had about *three weeks* previously laid such plans before them; that is to say, several weeks *after my plans* had been either in possession of the Select Committee, or at the War Office, Pall Mall, and more than a year after my plans had been presented to Sir Jno. Burgoyne, in whose possession they remained, and who did me the honour, with my full concurrence, of showing and explaining them, to several distinguished officers and to others. Was this generous or becoming as an objection to my propositions? Yet it figures formally as one *in this report.*

19, 20, and 21. Concede in reality the real value of the proposals made; they again deal with, and carp at, details only. It forms no *essential* part of my proposition that the hydraulic magazine of power should be obtained by means of *steam* pumping; if a *natural head* can be obtained near a battery, and the water brought down, so that the enemy cannot find out the pipe, or cut it off, it is best of all; but *any* mode of procuring it may be employed that is least objectionable. Is there something so greatly more formidable and liable to injury in a battery, in a pair of *duplicate* high pressure engines and pumps, placed deep down out of reach of shot or shell, than in the iron cupolo for Martin's shells, proposed to be placed actually in the battery, and for blowing which ultimately steam power will be no doubt employed.

So also it is no *essential* feature of my plan that a whole battery should be dependent, upon one set of hydraulic machinery, nor that the disabling of any one hydraulic worked gun, should disable any other.

And thus the Committee dismisses the subject, with (I believe I should be within numerical accuracy as to its past proceedings in 999 instances in the thousand projects brought before it) the usual *benedicite*, "for the reasons above stated it does not recommend any experiments," etc.

The facts are now before the public. The future shall decide whether the humble unit who now writes, or that "highly negative body," the Ordnance Select Committee, was nearer truth and wisdom.

ROBERT MALLET.

HISTORY OF THE SEWING MACHINE.

XXXVI.

(*Continued from Page* 290, *Vol. V., Second Series.*)

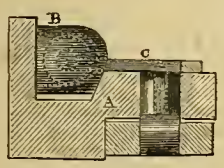
MR JOHN SAVAGE, of Nottingham, obtained Letters Patent, dated July 4, 1860, for an apparatus for facilitating the threading either ordinary hand sewing needles, or the needles of sewing or embroidering machines. Figs. 246 and 247 represent respectively a side elevation and cross section of the apparatus. It consists of a perforated plate, having grooves made in it to receive the needles, of different sizes, and the eyes of these needles, when properly adjusted, are in exact coincidence with the funnel-shaped perforations made through the plates, and the thread is consequently guided accurately through the eye of the needle when passed through these perforations. The inventor also proposes to make the plate in two parts, and to adjust each part in relation to the other, so as to render them suitable for needles of different lengths.

Fig. 246. Fig. 247.

W. F. Thomas obtained a patent for improvements in sewing machines on the 5th of July, 1860, which improvements consist of a peculiar form of shuttle and shuttle race, whereby provision is made for the wear of those parts, and of a peculiar mode of applying the pressure foot. Fig. 248 represents a transverse section of the peculiar shuttle race, showing the shuttle therein. A is the race, and B the shuttle, and C the driver; the back part of the race is inclined inwards, and the corresponding side of the shuttle is similarly inclined, the width of the shuttle being such

that when in its race it will not reach to the bottom thereof, but will be entirely supported by the sides—a space being thus left between the under side of the shuttle and the bottom of the race, so that as the race and shuttle wear away, the shuttle will continue to work in the same vertical plane, and, consequently, the front side of the shuttle will always work in front of the race, or on that side from which the loop formed by the needle is carried to project. As wear takes place, the shuttle will merely descend deeper in its race, but will still remain in contact with the front side thereof. This form of race is equally applicable to the ordinary shuttle, so long as care be taken that the shuttle, when first inserted, shall not rest upon the bottom of the race. The presser foot which holds down the work is mounted on a ⊃ shaped lever, the ends of the two arms of which are both on the same side of the axis on which the lever turns. The upper arm of this lever carries the presser foot, whilst the lower arm is arranged to be worked by a cam on the main driving shaft underneath the bed plate of the machine, the object of such cam being to lift the presser foot off the fabric when the feed bar is making its return stroke, and to lower it again when the feed bar is to propel the fabric. The feed bar has its upper face roughened or serrated, and moves to and fro horizontally. This appears, after all, to be merely a clumsy attempt to get over the peculiar feed motion of the Grover and Baker machine, as by simply imparting a rising and falling motion to the feed bar the complication of the presser foot mechanism is rendered unnecessary. The object to be attained in both cases is to enable the feed bar to make its return or back stroke without acting upon the fabric. Thomas does this by diminishing the pressure of the fabric on the bar, and Grover and Baker by diminishing the hold of the bar upon the fabric!

Fig. 248.



Provisional protection was granted to Chas. T. Judkins, on the 13th of July, 1860, for certain improvements applicable to sewing machines, which improvements were partly invented by the patentee, and partly communicated to him by J. W. Bartlett, of New York, United States, America. This invention is said to consist in sewing with a single thread, so as to make a loop stitch from a single needle of suitable form without the aid of a looper, the needle being so constructed and worked as to loop its own stitch, and by its action to feed forward the cloth without having such material under pressure. Another part of the invention consists in having grooves made in the feeding surface of suitable sewing machines, so that cords with coverings thereon, (such as are used in the cushions of railway and other carriages) and other articles of cylindrical form may be sewn as they are pressed upon such grooved surfaces.

Letters patent were granted on the 14th of July, 1860, to Lewis Hope, for improvements in "knot stitch" sewing machines, stitching with two threads. These improvements relate chiefly to the mode of communicating a reciprocatory rotatory motion to a horizontally rotatory hook, A, fig. 249, which makes about three-quarters of a revolution to and fro round the spool or thread case, B. This hook is actuated by means of the links, C, D, and E, guided by a curved groove, as shown in the underside plan at fig. 250, which links receive their motion from a crank on the driving shaft. Fig. 251 represents a section of the spool or thread case employed, the peculiarity of which is that its centre is seen from its upper case, whereby the operation of filling or winding on the thread is greatly facilitated, whilst the tendency of the thread to twist or untwist is prevented, and the tension, which is produced by passing the thread through an eye, *a*, in a stay, formed on the loose upper case, is rendered independent of the weight of the spool. The upper needle having passed a loop of the upper thread down through the fabric, the hook, A, takes that loop from the back of the needle, and passes it round the lower spool, thereby twisting it half round the lower thread, and fastening off each stitch as it is made, the peculiar knotted form of stitch so produced being shown at fig. 252. The spare thread of the upper bobbin is taken up by the aid of a spring attached to the needle arm, and combined with a thread lever carried on the end of the fixed arm or bracket. In order to counteract the twist which would be imparted to the upper thread by the passage thereof round the lower spool, a rotatory motion is given to the upper thread bobbin in a direction at right angles to the axis of such bobbin. The feed may be imparted to the cloth in any convenient manner, as, for example, by the ordinary roughened feed bar.

Fig. 249.

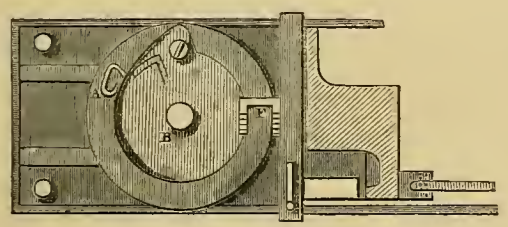


Fig. 250.

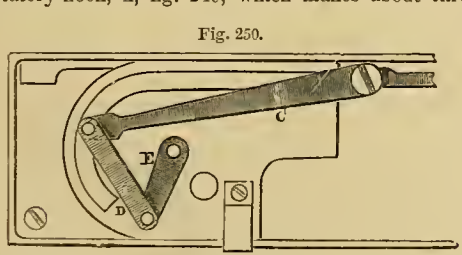


Fig. 251.

Fig. 252.

John Kenny obtained provisional protection for an invention on the 20th of July, 1860, embracing a shuttle sewing machine capable of making either the "lock" or "knot" stitch, by simply varying the delivery of the shuttle thread. A peculiar discoidal shuttle is proposed to be used, contained inside a stationary circular shuttle box, facility being afforded for delivering the thread, which is contained on a spool having its axis in a line transverse to the axis of the shuttle, either through holes at the periphery, or through other holes near the axis or centre of the spool. The plan of the outline of the face of the shuttle is somewhat in the form of a crescent, with one horn rounded off, and the other forming the nose or point, which is made flexible, being formed of a spring, or jointed so as to insure its taking into the loop of the needle thread, thereby obviating the chance of missing a stitch.

William Ford and Thomas Proctor obtained provisional protection on the 2d of August, 1860, for certain improvements in sewing machines, embracing the use of a slotted crank to drive the shuttle, whereby the necessary rest or dwell of the shuttle is obtained. Also, the combination with the needle carrier of a feed foot so disposed that the necessary rise is imparted to the foot to free the work, and a backward motion is given to it, which motion, upon the needle being freed from the work, is converted into a downward and forward motion, whereby the feeding of the work is regularly kept up through the agency of the needle carrier. The foot proper is furnished with a heel rising up at the back of the leg which carries the foot. The amount of feed is adjusted by means of suitable adjusting screws. The invention also embraces the use of a bar or bars centred in an oscillating block, and formed at one end with an eye, through which the thread passes from the bobbin to the needle, whilst the other end extends beyond the block, and on every stroke of the needle carrier, a pin projecting from the top thereof raises this end of the bar, and depresses the carrying eye through which the thread is passed, and so keeps the thread in proper tension. A spring is employed for pressing against the bobbin, carrying the needle thread together, with a screw for regulating the pressure against the bobbin. This spring is so connected to the frame of the machine as to admit of its being turned out of the way when desired. A spring is also applied in the shuttle, pressing against one end of the spindle of the thread carrier, so as to prevent it from becoming loose therein.

John Hall obtained provisional protection, dated the 3d of August, 1860, for a method of imparting motions to the feed apparatus, needle, and shuttle, from a cam or eccentric underneath the machine. Also, for regulating the length of stitch by a screw outside the machine; also, for winding the thread or silk on to the shuttle bobbin by the frictional contact of the periphery of the fly or driving wheel, with a pulley on a small spindle carrying the reel or bobbin.

Wm. Clark applied for provisional protection on the 3d of August, 1860, for an invention communicated to him by A. Maureau, of Paris, comprising an embroidery machine for producing the tambour or chain stitch, by means of a rotatory hooked needle penetrating the cloth, and supplied with thread from an eccentric rotatory tube or thread guide, which passes the thread round and into the hook when it has penetrated the fabric, so that on the next upward motion of the needle, it will be drawn through the fabric in the form of a loop, which is retained on the shank of the needle until the next succeeding loop is drawn up through the fabric and through the preceding loop, thus forming a chain stitch. We have given a more detailed notice of this invention than we should have done had not the same arrangements been equally applicable to a sewing machine proper.

Another provisional protection for a sewing and embroidery machine was granted to Pierre Mauvillin, on the 9th of August, 1860, which enabled the attendant to guide the needle in any desired direction, according to the pattern to be produced. The stitch is produced by a needle and shuttle, and the fabric to be operated upon is held stationary whilst the sewing or embroidery instruments are moved over it in any required direction to suit the design to be embroidered.

Daniel Foxwell obtained letters patent dated August 18, 1860, for an invention consisting of a tambour or chain stitch sewing machine, provided with a vertical needle having an eye near the point working in combination with a horizontal bell crank beneath the table, to which a to and fro reciprocatory motion is imparted by a cylindrical grooved cam. The free end of this bell crank is pointed, so as to enter the loop of the upper needle when below the cloth, and extend and hold it until the needle again descends through the cloth, and the loop so extended, after which the loop is released by the backward movement of the bell crank, and the next loop is seized before the rising of the needle, and so on throughout the series of stitches.

Silas Covell Salisbury and John Farmerly Dickson, obtained provisional protection on the 31st of August, 1860, for improvements on sewing machines, consisting of a peculiar mode of operating the vertical needle and feeding foot directly from the driving shaft, and in making the stem of the feeding foot with a vertical slot, the lower part of such slot being at right angles to the upper part, so as to form a support for the foot, and maintain it elevated, when the holding pin is in that part of the slot. The shuttle, or the horizontal looper, whichever may be employed, is actuated by a vertical rocking shaft mounted in the hollow standard of the machine, and driven by a cam or the driving shaft. A horizontal arm, keyed on the lower end of this spindle, gives motion to the shuttle carriage.

Benjamin Nicoll, of Regent Street, obtained provisional protection, dated Sept. 7, 1860, for a remarkable invention, consisting in magnetising sewing machine needles, for the purpose of making them cling to the parts whilst being fastened or adjusted, and also in magnetising those parts of the machines to which the needles are to be applied, and as to obtain the same results when using ordinary or non-magnetised needles. The object of the invention is to facilitate the proper adjustment of the needles by preventing their shifting whilst being placed in their proper positions.

Provisional protection was granted on the 15th of September, 1860, to G. Francis Bradbury and J. J. King, for certain peculiar forms of binders, so constructed as to move in the race edges of those bindings having no selvage.

Maximilian Simon obtained provisional protection on the 19th of September, 1860, for a mode of producing gathered work in sewing machines. Mr Simon proposed to accomplish this by a contrivance applicable to any ordinary sewing machine, and consisting of a thin bar or strip of metal, which is interposed between the two fabrics to be stitched together, when one of such fabrics is to be gathered and stitched on to the other in the form of a frill. One edge of this bar is brought nearly up to the point, when the needle penetrates the feed bar, being permitted to act to its full extent in the usual manner upon the lower fabric, whilst, in consequence of the thin bar or plate, it is prevented from interfering with the other and upper fabric, hence, it follows that the lower fabric will be fed along quicker than the upper one, and will, consequently, be puckered or drawn into plaits or gathers, which are stitched upon the upper fabric by the needle and other accessory instrument.

Provisional protection was granted on the 26th of September, 1860, to Joseph M'Crossan, for an invention communicated to him by George Juengst, of New York. These improvements relate to shuttle machines with the wheel feed motion. The needle carrier is actuated by a rotatory crank or eccentric pin, through a short link or connecting rod, to which rod is fixed the take-up finger or slack preventer for tightening the stitch. The feed is regulated by means of a screw acting in combination with a spring on the feeding cam.

Charles Callchant, of Paris, obtained a patent, dated October 5, 1860, for a complex arrangement of mechanism for producing the whip or overcast stitch. The thread is used in short lengths or needlefuls, and the needle is hooked and draws the thread through the fabric, the thread being supplied thereto by a suitable thread guide or distributor. A hooked instrument is employed for separating the two ends of the thread on leaving the fabric for the purpose of enabling a distender provided with a hook to stretch the needleful of thread, the required tension for tightening the stitch by two blades acting upon the thread. The fabric is held by comb holders or nipping jaws, opened and closed by a treadle, the notches in the combs being suited to the particular size of stitch to be produced.

Gavin Young obtained provisional protection on the 17th of October, 1860, for certain peculiar arrangements of hemming and binding gauges, but of which the description given is too vague to be clearly intelligible without drawings.

A. V. Newton obtained provisional protection on behalf of W. C, Hicks, of Boston, United States, America, dated the 7th of November, 1860. This invention consists partly in giving security to seams formed by the tambour or single thread chain stitch, and preventing them unravelling or ripping; and when one of the series of stitches has given way, by introducing into the line of stitches, at suitable intervals, short stitches which will retain the loop of the adjacent long stitch. For this purpose, the back traverse of the feed bar is arrested at say every second or third stitch by a rotatory cam, which receives motion from the looper shaft, and by being thus corrected it will make a proportionate short forward traverse, and thereby feed the cloth the proper distance for throwing in the short stitch. The regulation of the length of this short stitch may be effected by shifting the arresting cam on its shaft or otherwise, and the length of the other stitches may be regulated in the usual manner.

Provisional protection was granted to the same gentleman on behalf of the same inventor, dated the 8th of November, 1860, for an improved tension apparatus in shuttle machines, whereby a large amount of slack thread may be thrown off to form the slack loop through which the shuttle passes, thereby admitting of large sized shuttles being conveniently used. Another part of the invention consists of a mode of elevating and lowering the feed wheel in its bearings, so as to suit different thicknesses of work.

John Ward obtained provisional protection on the 13th of November, 1860, for an improved system or mode of applying thread to the needles of embroidery machines, and also for an improved method of working the same. He proposes to use a double thread, stitched together near the eye of the needle, or left loose, thereby allowing two threads to be marked together in lieu of a single thread. The double threads may be of the same or different colours or materials. By this system of working, one stitch, formed by the pantagraph, forms two stitches in each repeat of the design, thus economising the time of the worker.

Provisional protection, dated November 15, 1860, was granted to A. V. Newton, on behalf of Dwight Tracy, of Worcester, United States, America, for certain means for controlling the needle therein, whereby the quantity supplied to the needle is caused to be always in proportion to the thickness of the fabric and length of stitch, a uniform tightness of stitch being produced whatever variation may occur in the thickness of the fabric, or however the feed movement may be varied, or whatever may be the relative sizes of the needle and thread, thus obviating the necessity for any manual adjustment of the needle thread. The invention also refers to certain means of controlling the shuttle thread, whereby it is caused to be drawn to a uniform tightness in the fabric, without regard to the quantity of the thread on the bobbin, or to the part of the bobbin from which the thread may be drawn. Also, to the forming of a knotted stitch of a peculiar nature, produced by the employment of an elastic fork working above the cloth which enters and spreads the loops of the shuttle thread, which are drawn up through the cloth by the needle thread, two operations of the needle, and a movement back and forth of the shuttle, being required to perform each stitch.

Letters patent were granted to Rudolph Bodmer, on behalf of Messrs C. B. Gruner and G. A. Keller, hearing date the 16th of November, 1860, which relates more particularly to the folding and stitching together of sheets of paper for binding. The stitching apparatus is construeted for single or double stitching folded sheets, and may be applied so as to form part of the folding machine. The stitching takes place before the last folding, and on the line of the last fold. For double stitching, two pairs of needles are used, each with a bobbin of thread of its own. For single stitching, only one pair of needles are employed. The needles are fixed to a bracket, which has a backward and forward motion from and towards the folded paper—the threads from the bobbins are seized at the ends by small pincers cut to the proper lengths by shears, actuated by the apparatus and supplied to the needles which pierce the paper and deposit the threads in it.

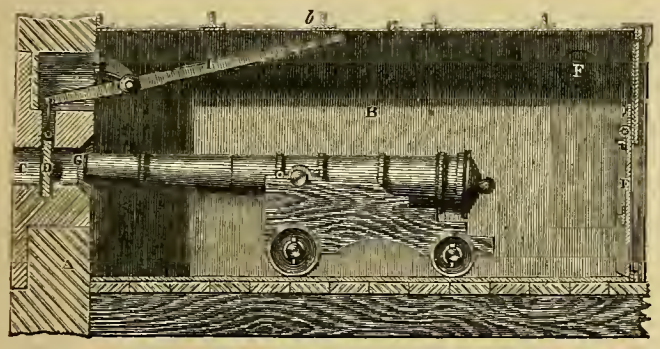
DISCHARGING CANNON UNDER WATER.

The following is an abstract from recent Letters Patent granted to Mr Page, C.E. He says, in vessels of war or other floating batteries I place a gun or guns each in a chamber disposed below the water level, and into this chamber I force air at a pressure greater than that due to the pressure of the depth of water at which the gun is placed. Each gun chamber is connected with a reservoir, in which a plentiful supply of condensed air is maintained. The gun being loaded, placed, and trained in position by suitable apparatus, I open a port in the ship's side below the water level, and fire the gun through such port, which is again immediately closed. The pressure of air in the chamber causes a rush of air outwards, and prevents the ingress of water to any extent. While firing batteries with the guns so disposed, I propose to bring the guns into sufficient proximity to an enemy's ship and fire it below the water level; the projectile will therefore pass through the water, strike, and enter the enemy's ship below the water line and so contribute to its

destruction. Guns so situated may be worked by the men in the ordinary way, they being also in the gun pressure chamber.

Guns worked and discharged in compressed air chambers according to my invention would in most cases be fired point blank, and would not in any case require to be elevated, but in very close quarters with an enemy might be depressed with advantage. In practice, however, I think the gun might always be maintained at a uniform level, and in which case the port or hole in the ship's side may be made of a size to correspond somewhat in diameter to the muzzle of the gun. The gun having been loaded and brought into position, the supply of compressed air is admitted to the gun chamber. The port is opened and the gun discharged, watching the motion of the ship, and taking care that the gun is in a horizontal position at the time of the discharge, or it may have a slight depression from such motion if desired at such time. A projectile so discharged will enter the water at right angles thereto, traverse through it, and strike an object (say a vessel) below the water line. The passage through the water will, of course, diminish the force of the projectile very rapidly as compared with air; it is therefore desirable to bring the gun within the closest possible proximity to the object to be hit in order to produce the greatest possible effects. By this means ships that are vulnerable below the water line may be very easily destroyed, the effect of shot there entering will be readily understood.

The subjoined engraving represents a portion of a ship's side, A, in section, and adjoining it a close or air-tight chamber, B, with the gun enclosed. I form the chamber of iron or other suitable material, the metal sides, A. and other parts being supported by angle irons, *b*, *b*, or other supports of a strength commensurate to the pressure of air to be introduced. In the ship's side is fixed a heavy casting of iron having a port or opening, C, of a diameter somewhat larger than the bore, or it may be the muzzle of the gun; in this is fitted a slide, D, acuated by a



hand lever, I, as seen, or suitable machinery, so that the port can be readily opened or closed by raising or lowering the slide, D. This slide is snitably fitted so as to exclude water when closed. In the chamber, B, I form a door, E, which I hinge at the upper part, and provide tackle for raising or lowering it as desired and as seen dotted. The gun may be withdrawn from the chamber by the door, loaded and returned to position for firing. Before firing, the door, E, must be lowered and closed; if provided with suitable india-rubber packing all escape of air may be prevented. One or more gunners enter the chamber, B, at the time of firing, and either work the port slide, D, from within or by signal from without. If the chamber, B, is small, the gun may be confined by a suitable breeching to prevent excessive recoil or beyond a certain extent. Instead of the gunners entering the chamber at the time of firing, the gun may be placed in position, after which the gunners leave and close the chamber, and then fire the gun by electricity or other suitable means. Instead of chamber, B, being small, it may be of large dimensions and the gun worked within it, but this may be objectionable on account of the pressure of air required to be employed which may be made more available in the smaller chambers. There may be one, two, three, or more such gun chambers in each ship, for the purposes of which I employ suitable air pumps worked by steam or other power, by which pumps I condense air to a suitable pressure in a large reservoir, and maintain a sufficient supply therein for the purposes of working the inveution, which pumps and reservoirs it will be unnecessary further to explain; F, represents the orifice of the tube entering the chamber, B, from such condensed air reservoir; this tube should be of an area sufficient to supply air as rapidly as it can escape by the open port; it is furnished with a suitable stop valve. The gun having been brought up to the port with the muzzle entering it and fitting more or less closely, the chamber, B, closed, and the air supply valve opened, all will be in readiness for firing. The port slide, D, is now raised, disclosing the opening, when the air confined immediately rushes out, forcing the water from the port, and preventing its ingress; the gun is then immediately fired and the port slide again closed. Instead of the gun muzzle being brought up against the chamfered edge of the port hole, it may be made to enter the port a considerable distance, and fit somewhat closely thereto. The air, instead of finding access to the port hole around it, may be conducted by separate channels to a position between the muzzle and the slide, such channels having valves that permit the outward escape of the air for the purpose of blowing out and keeping out the water, but which shut against any pressure of the explosion that might be exerted against them to enter or return thereat.

Having described the nature of this invention, and the manner of performing the same, what he claims as his invention is, the use and application of a chamber, and maintaining a pressure of air therein, for the purposes of firing and discharging projectiles below the water level, as herein-before described.

The foregoing specification of Mr Page's embraces a very odd mode of carrying out a very odd notion. Notwithstanding the reputation that the inventor possesses as a practising engineer, we feel perfectly satisfied that this arrangement of his, will never be put in practice, and that, in fact, a more exact knowledge of the nature of the forces concerned, would have prevented such a project ever having become patented.

We shall not, in the first instance, dispute the utility of the invention, upon the very obvious ground, that unless a ship could fire her under water shot within less than fifty feet of her enemy's broadside, in a direction almost precisely perpendicular to the surface of the hull aimed at, and in perfectly still water, the effect of even a 100-pound Armstrong bolt, projected into the water, would be perfectly harmless to the antagonist, perhaps nearly so even then.

But assuming the missile for the moment effective, and all the arrangements for the emission of the shot under water perfect, we shall just inquire what effect the discharge is likely to produce upon the ship whence it is fired, and upon the gun itself that is discharged.

Several years ago, a train of most important experiments was completed at Metz, by the French artillery service, as to the power of projectiles to penetrate in water—the distance they could be driven through the fluid, etc. They commenced by providing a common rectangular wooden trough, of about a foot wide, the same depth, and about thirty feet in length. The trough was all of wood about two inches thick, well secured together, except one end, which was formed of a sheet of waterproof cloth. The trough was laid horizontally, filled to the brim with water, and then a common musket was fired through the water-proof cloth in an horizontal direction, and exactly along the centre line or axis of the trough, means having been taken to ascertain how far, along the thirty feet of its length, the bullet should be propelled through the column of water.

To the surprise of every one, the instant the shot was fired, and the bullet had pierced the water-proof cloth, the whole four vertical sides, i.e., the two sides and one end of board, and the other end of cloth, were all blown asunder, and laid down flat, on the ground close beside the bottom of the trough, and the water spilled.

The curious result had not been anticipated, but it had no sooner happened, than the causes producing it were evident. The bullet entered the water of the trough at a velocity of say 1600 feet per second, through a hole of say 5-8ths of an inch diameter; its effect was that of the impact of a small piston of the same diameter, driven into the water at the preceding velocity. At this great velocity of applied force, the water in the trough could not give way at a corresponding velocity, but the impulse itself was transmitted through the fluid to its remotest corner, with a velocity far greater than even that of the projectile, viz.:—at that of the modulus of pulse or wave transmission through water, or nearly at the rate of sound in water, namely, at about 4300 feet per second. The impulse due to the great circle surface of the bullet was hence instantaneously conveyed, nearly unaltered, to every equal portion of the internal wet surface of the trough; the latter was placed in the position of the interior of an hydraulic press, and so its sides were instantly blown asunder by the enormous *quaquaverse impact* thus delivered upon them.

Now, precisely an analogous effect would be produced upon the under water surface of the ship that fired a gun out of Mr Page's under water port hole. The impact of the shot upon the water just outside the hull, would be instantaneously propagated, *in all directions alike*, through the fluid; it would produce a correspounding blow, therefore, upon every equal surface of the ship in contact with the water, and quite as much in the *directly opposite direction to that in which the shot was fired, as in any other*. The result would be that the discharge of a heavy gun, under such circumstances, would, in the case of an iron ship, shake every rivet in her frame loose, and even with a timber ship produce a shock that probably would instantly render her unseaworthy.

So much for the ship. What further would happen to the gun, and to the unfortunates in the air-tight chamber? It is scarcely worth while following the phenomena through various possible conditions, but let us take only one of the several modifications proposed by Mr Page, viz., in which the gun muzzle stopped with a light tompion is in actual contact with the water. The gun certainly *might* stand the explosion without

bursting, but the rceoil would as certainly send it over against, if not through, the other side of the ship. As to any man remaining in the condensed air chamber, and coming out alive after the explosion, it will not seem prohable to those who know the effects cven of very slight impacts upon the lungs in compressed air.

In a diving bell for example, under not more than five fathoms of water, a sudden drop of the bell, by surging of tbe tackle or other such cause, of only six inehes—producing a sudden increase of pressure on the lungs of less than a quarter of a pound additional per square inch of surfaee—is sufficient to cause exquisitc torture at the moment, and with most men to produce temporary bleeding of the lungs. In Mr Page's condensed air chamber, tbe air would beeome *more condensed* at tbe moment of the explosion hy almost the whole volume of evolved gases, from the powder, none of which would have time to escape; and although *this* impact from the gun, would also be *quaquaverse*, and be visited upon all parts of the interior of the condensed air ehamber and on the men's lungs at the same moment, and though it would be buffed by the high comprcssibility of the air, as contradistinguished from the nearly incompressible water outside, yet, in all likelihood, thc chamher itself would be blown asunder at the instant of discharge.

Wc are compelled to prononnee Mr Page's plan absolutely impracticable, and were it praeticable, we entertain the strongest douht that the shot so fired would be worth anything as an effective missile.

It may perhaps be just possible, that good serviee might occasionally be done against armour ships, hy firing a gun, whose muzzle should be *close to* thc water line of the attaeking ship, and which gun should be trained to point downwards into the water at au angle of perhaps 20° to 25° from the horizontal—and were there any real want for sueh, we ourselves see the means by which such a gun, (or one even under water, if it were safe to fire it there,) could he fired out through the ship's side and into the water, without the aid of any condensed air chamber whatever. But in no case could such an arrangement be of the least use in a sea-way; were a shot projeeted into the sea when tumhling about in wave movement, to several feet in depth below the mean surface, its trajectory would instantly become deflected hy, and iuvolved with the motions of the wave particles of the water, and its course become as uncertain as theirs, and its stroke after a few yards powerless.—Ed.

WATERLOO PALACE.

Parliamentary plans have been lodged this session in connection with the following objects, extraeted from the formal public notices:—

"Waterloo Palace.—(Incorporation of Company.—Construction of an Edifice over Waterloo-bridge—Arrangements with the Company of Proprietors—Amendment of Acts and for other purposes.—Notiee is hereby given, that Application is intended to be made to Parliament in the ensuing Session for an Act for all or some of the following, among other purposes):—

"1. To incorporate a company by the name of 'The Waterloo Palace Company,' or by sueh other name as Parliament may think fit.

"2. To authorize the Company so to be incorporated (herinafter called the company) to make and maintain an edifice or ornamental structure to consist principally of iron, glass and slate, with all eonvenient and neeessary approaches, and other works and conveniences in connexion therewith, which said edifice or structure and works will be made and maintained over and above the existing carriage road and pathway of Waterloo-bridge.

"4. To authorize the Company for the purposes aforesaid to purchase compulsorily, or otherwise to acquire, take, and appropriate in such manner, and upon such terms as shall be provided for by the said Act, such portions of the carriage road and pathway, abutments, piers, and other works of the said Waterloo-bridge, situate as aforesaid, and the approaches thereto, as the said Company may require.

"6. To authorize the Company to take and reeeive rents, tolls, rates, and duties for the use of the said edifice, and other works to be erected by the Company, or any part thereof, and to alter and extinguish existing rents, tolls, rates, and duties leviable upon or in respect of the said hridge, and to confer, vary, or extinguish exemptions from the payment of the same; and to vary and extinguish all or any rights or privileges which would in any way prevent the carrying out of their said undertaking or any part thereof, and to enable the Company to contract for the sale or lease of their undertaking, or any part thereof, to any person or persons willing to purchase or lease the same, and to enable such person or persons to purchase or lease the same accordingly."

The plans lodged are in two sheets only, and show a plan and elevation of the proposed structure. Messrs Vallance & Vallance are the Solicitors names attached to the notiecs, and Mr Frank Lang Arch, is that of the Architect or Engineer. The project meditates the construction of a permanent arched or concrete floor, over the whole existing roadway of Waterloo-bridge, and at a height of 29 feet above it. Above this floor, a continuous one-story building is projected, open at the sides or glazed in, and covered by a continuous roof, rising highest at the centre division of the whole length. From the level of the existing roadway to the ridge of this roof at the lowest and greater part of its length is 64 feet, and 90 feet from the same road level to the highest part, while the apiees of the very highest points of certain melon capped towers, rise no less than 130 feet above the carriage way. It is proposed to encumber the present passage of the bridge hy two lines of columns at only 18 or 20 feet apart, one along the front edge of each footway, and to construct large buildings containing stair cases, at either side, and at both ends of the bridge approaches. The upper story is to be carried upon the preceding columns, and upon others imposed upon the pedestals, &c., of the ballustrade. The side spaces between these are apparently to be left open. The building above is to consist of two long strips of covered space of only about 50 feet wide, called "Winter Garden Promenades," of two Pavilions, whatever that may mean, and of a Concert Hall in the centre. The style as shown in the broad side elevation, would be hard to characterize, as anything beyond confectionary. Altogether this project appears to us, a move in precisely the wrong direetion. It proposes utterly to spoil one of our best bridges, and one of John Rennie's noblest works—by the imposition of a most absurd and incongruous structure in point of taste. The effects of this erection would be, greatly to diminish the available passage as it now exists; to make the roadway dark and comfortless; a tunnel always piereingly cold in winter, and wet on the weather side, from the draught sweeping through the open side spaces, and intolerable with dust in summer. The rearing of such a great aerial dam, standiug hetween 60 and 70 feet high, right across the Thames, and directly opposed to the great prevailing east and west currents, that now serve to ventilate and purify our enormous metropolis, is highly objectionable in a sanitary point of view. Were there no other objection, this we think ought to be conclusive with Parliament in preventing this work being proceeded with. The argument that will no doubt he advanced as cogent in its favour before the House of Commons, will be, that it in fact proposes, without destroying the value of the bridge property, or burdening the public purse, to purchase it up, so as to throw it open toll free, or with greatly reduced tolls for public passage. The reply to which we conceive to be, that were this all true, the advantage gained would be dear when thus obtained. We hold it, that the past experience of toll bridges in and above London demonstrates, that it should be henceforth held as an inviolable principle, never again to permit any fresh proprietory rights of any sort to fasten themselves upon the great highways across the river.

If this project becomes law, and he carried out, for it is not quite incredible that, circumstanced as the bridge property is, funds might he found to attempt it, the result would be in a few years, that the so called Pavilions and Winter Gardens, would be a nest of toy stalls, and so forth, the Concert Room a great central Casino, aud the Winter Promenades, the best parade ground for the saddest scenes of our streets. Few will judge that this thoroughfare across the river would be improved, by being blocked up every now aud then, by the carriages and masses, attending so called Pavillions and Concert Rooms, &c., the length of Waterloo-bridge.

How far the proposed building would be safe in a structural point of view, we have not the data yet to pronounce upon.

Those whose remembranee of Engineering Literature is sufficiently fresh, however, will recollect, that there were some peculiarities in the foundations of the piers of Waterloo-bridge, and in the spacing of the piles, as fixed upon by John Rennie, which, with other circumstances that it is needless now to refer to, resulted in several of the piers having become fractured, for many feet from the footings upwards, towards the springing of the arches, many of these fractures produced by unequal insistent load, and unequal support below, may any day he seen at low water, in the piers at the northern end of the bridge, and at places from 3 to 4 feet inside the plumb line, dropped from the face of the ring pens at the piers.

They are enough to show that the bridge should not be tampered with. Although the alleged weight of the proposed structure may he stated as comparatively small—when once up, no one can say what limit it may afterwards have.

"Something ought to be done with Waterloo-bridge." So we have been hearing all our lives, and we fully agree that it is one of the many anomalous reproaches of our London "trivia," that the paltry "date obolum" at each end should make so useless, a thoroughfare so much needed and that would be otherwise so much employed—but this is not "The Something" needed—to us "The Something" suggests itself thus —Purchase up all existing property right, in it (and in Southwark too), as part and pareel of the Embankment measure; widen out the bridge 30 feet, by projecting cast iron footways, throwing the whole present breadth of each into carriage way, and throw them open with proper approaches from the embankment terraces, toll free to the public. In any case let us not now in the post meridian of the nineteenth century, have a gingerbread, tasteless and tawdry restoration, of the houses and shops of old London-hridge, removed thence as an intolerable nuisance a century or two ago.—Ed.

MOVEABLE SERRATED BAR FURNACE,

Mr JOHN WATSON, *ENGINEER*, GLASGOW, PATENTEE.

1st APRIL 1862.
Second Series
Vol. VII.

Plate 285.

Fig. 1.

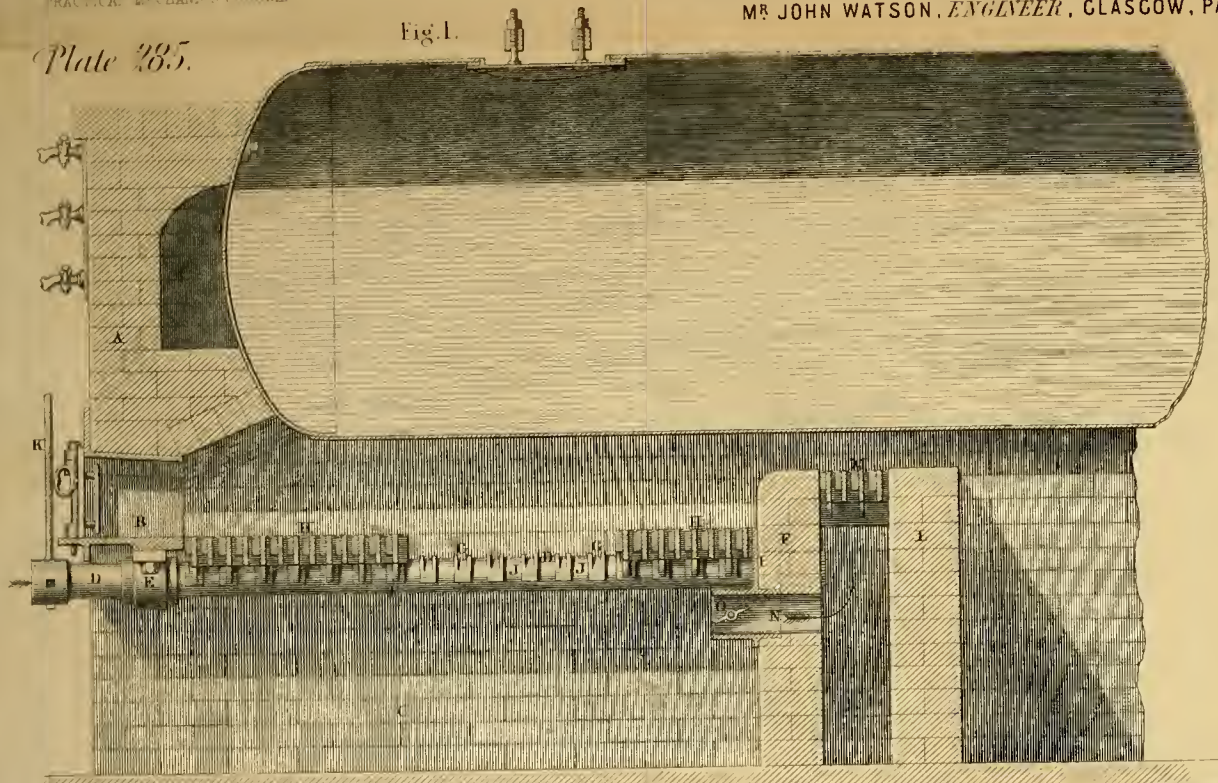


Fig. 2.

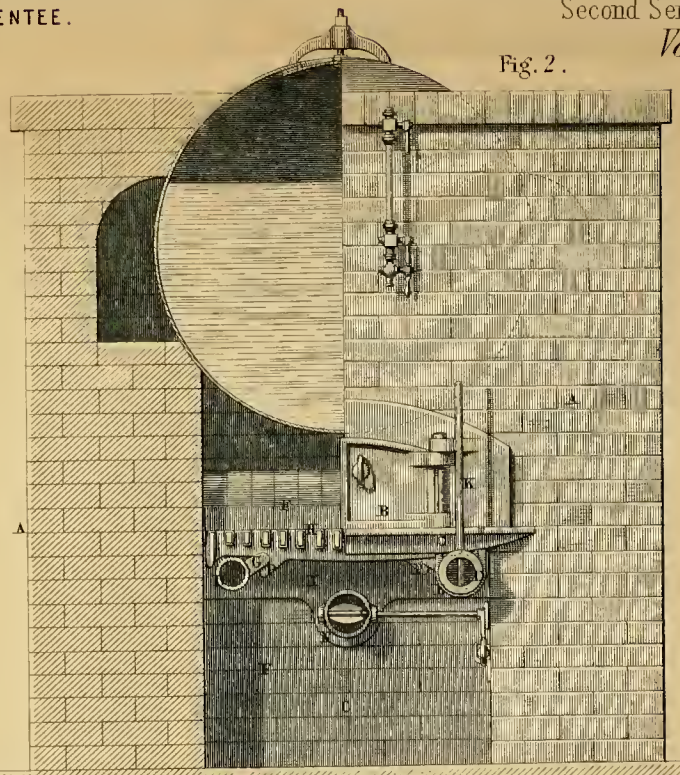


Fig. 3.

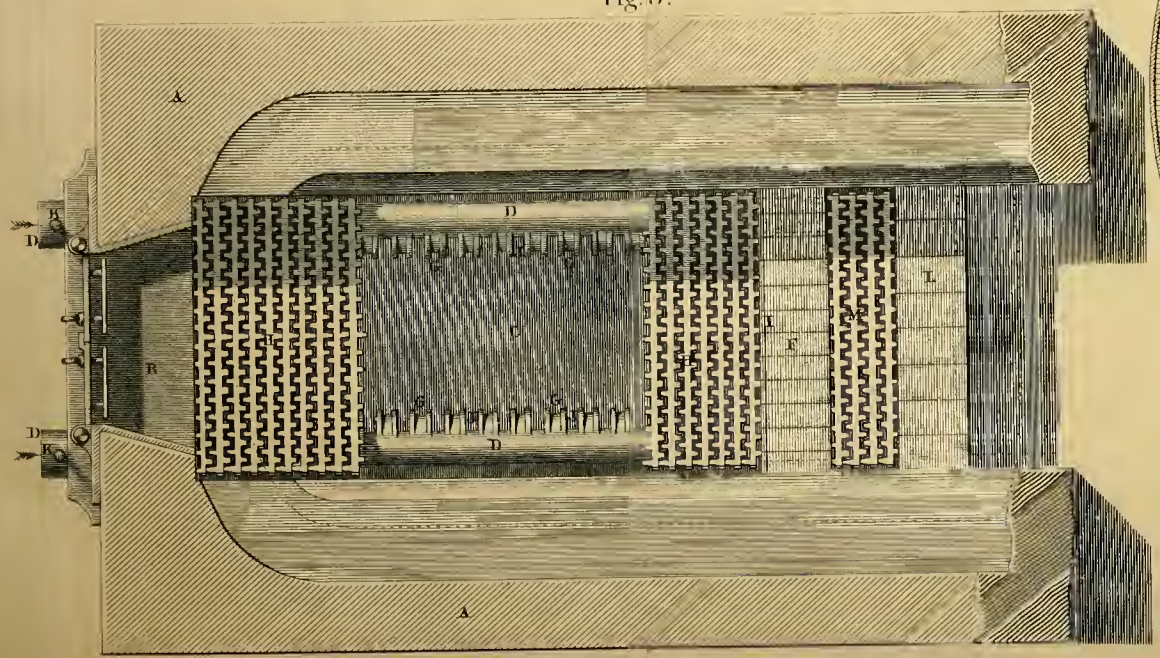


Fig. 4.

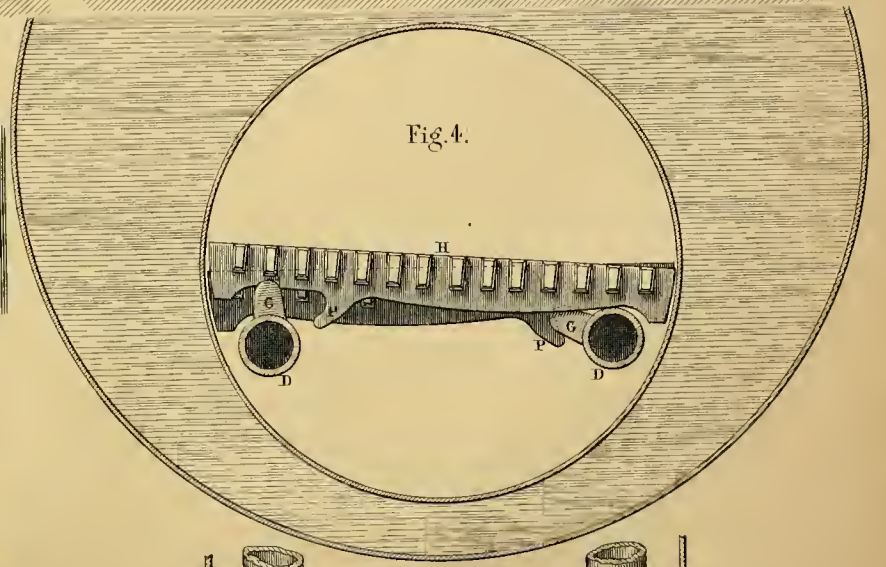
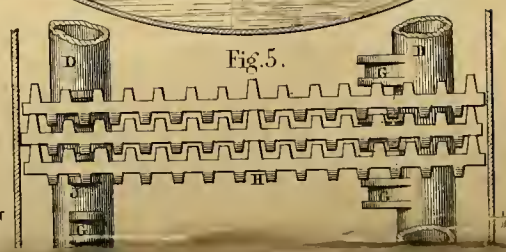


Fig. 5.



SCALE.

INS. 12 9 6 3 0 1 2 3 4 5 6 7 8 9 10 FEET

W. Johnson, Patent Offices.

MOVEABLE SERRATED BAR FURNACE.

By Mr John Watson, *Engineer, Glasgow, Patentee.*

Illustrated by Plate, 285.

The arrangement of the furnace shown in the plate accompanying this Journal is the invention of Mr John Watson, of Cochrane Street, Glasgow, Engineer. The Patent Furnace has proved highly successful in the numerous instances where it has been applied. The peculiar arrangement of the serrated bars, together with the movement imparted thereto, effectually prevents the formation of clinkers, and at the same time introduces a large volume of air, which becomes thoroughly heated before it reaches the gaseous matters evolved from the fresh fuel, which are thus flashed into flame, and the invisible non-combustible vapour only passes off from the chimney.

Fig. 1 of plate 285 is a longitudinal vertical section of a furnace, (part of the boiler and brick work being broken away,) showing one arrangement, as applied to the heating of an ordinary boiler. Fig. 2 is a half-end elevation and half-transverse vertical section of the same, at right angles to fig. 1; and fig. 3 is a plan corresponding to fig. 1. Fig. 4 is a transverse vertical section, to a larger scale, of the details and bars as applied to the internal furnace of a circular flue steam boiler; and fig. 5 is a plan of a few of the furnace bars. The brick work, A, of the furnace is arranged in the ordinary way, the dead plate and furnace mouth, B, is of the usual kind. Extending beneath this on each side of the ash pit, C, is a tubular shaft or air passage, D, which is supported at the front end by a curved bracket, E, pendent from the dead plate of the furnace. If found preferable, the front part of this air passage may be supported on the inner side by a semi-circular pendent bracket cast on the under side of the dead plate, and outside by a corresponding moveable support bolted up to the dead plate. The backward end of each air passage, D, passes through and rests in a cast iron plate and back bridge, F, which forms the extremity of the ash pit, C. On the inner portions of the peripheries of the air tubes, D, are cast the laterally projecting teeth, G, which act as cams to raise each alternate fire bar when the air tube is turned partially round. The fire bars, H, are cast with laterally projecting teeth or serrations, the end teeth, and one in the centre, being made a little longer than the others, so that when arranged on the air tube, D, the bars are placed close together, these teeth serving to give steadiness to the bars, and, at the same time, leave a sufficient space between the intervening teeth, as shown in the plan views, figs. 3 and 5. The bars are hollowed on the under side, so as to rest fairly on the upper part of the air tubes, D, and they are arranged across the furnace at right angles to its length. Each tooth of one bar enters the corresponding recess of the contiguous bar, but the elongated teeth at the ends and centres are the only ones which touch the neighbouring bar. The bars next the inner end of the dead plate, and also the back plate, I, are made with shorter teeth, but the edges of these plates might be serrated to correspond with the front and back bars; the other bars are slipped into their places, and arranged parallel, filling up the longitudinal extent of the furnace to the back plate, I, which forms a facing to the fire bridge, F. The teeth, G, on the air tubes, D, are formed with recesses at the central part of each; and these are arranged at such a distance asunder that the lower part of each bar falls into one of these recesses on the one side, and at the other into the space, J, between the teeth, G, each tooth, G, being opposite a space, J. It follows, from this arrangement, that if the air tubes, D, are turned partly round, each alternate bar will be raised up at the end on that side of the furnace on which the air tube is actuated. This motion of the alternate bars arises from the cam-like form given to the central part of each of the teeth, O, the inclined plane of the central part serving to lift the bars which rest thereon, whilst the intermediate bars are unaffected, because they rest simply on the cylindrical surface of the air tube, as delineated in fig 4. The front ends of the air tubes, D, project out beyond the brick work, A, and holes are formed in the rim to admit of a bar or hand lever, K, being inserted therein. When the furnace is working, the stoker, from time to time, moves the hand levers, K, to and fro alternately, which raises up the fire bars, H, breaks up the fuel, allows the ash to fall through, and prevents the formation of clinkers. The raising of the bars from time to time has also the effect of causing a large body of air to pass into the fuel, and it is thus kept in a state of intense combustion. The arrangement of the furnace also provides for the effectual combustion of the inflammable portion of the gaseous matters evolved, and thus prevents the emission of visible smoke from the chimney. The tubes, D, convey a considerable body of air into the chamber formed between the fire bridge, F, and the secondary bridge, L, built parallel to the first. The upper part of this air chamber has four or other number of the serrated bars, M, arranged at the top of the fire bridges, which serve to divide the air, and cause it to issue in streams, which meet the smoke and ignite the combustible portion of the gaseous matters. In the centre of the plate, I, is a third tubular aperture, N, to admit, if required, a further portion of air, the admission of which is controlled by the throttle valve, O, regulated by a rod extending to the front of the ash pit, or in any other convenient way. In wide furnaces, the weight of the fire bars, and of the fuel resting thereon, is sufficient to cause them to descend on to their bearings, after being raised by turning the tube, D. But in furnaces of the narrower kind, mechanical means are provided for drawing the bars down as well as raising them; this arrangement is seen more clearly in the sectional view, figs. 2 and 4 of the plate. In this arrangement, each bar is made with a curved snug, P, cast on its under side, and projecting in an angular direction towards the teeth, G, on the contiguous air tube, D. One-half the bars in the furnace are cast with the snugs at one extremity, and one-half with them at the other; and when arranged in the furnace they are placed with the snugs right and left, as shown in figs. 4 and 5. Thus, when either of the air tubes, D, is turned partly round, one-half of the bars are raised by the teeth, G; and as the tube is turned back to its normal position, the lateral portion of each tooth, G, catches on the contiguous snug, P, and ensures the due descent of the bar. These hollow shafts or air passages may be arranged for a complete rotatory motion, and may be actuated by steam power when preferred.

PRIZE LIST OF THE FRENCH ACADEMY OF SCIENCES.

The annual list of subjects for prizes, and the relative amounts to be given by the French Academy of Sciences, has just been issued. As these important prizes are open to public competition, our readers may, perhaps, study them with some advantage, and we accordingly reproduce them here:—

Mathematical Sciences.

The examination of the tidal theory in connexion with observations made on tides in various ports in France, 3,000 francs,—The improvement of the geometrical theory of polyhedrons, 3,000f.,—To ascertain the state of caloric in a solid homogeneous body, 3,000f.,—To analyze and improve the results hitherto obtained in the theory of plain curves of the fourth order, 3,000f.,—The best mode of economizing the use of steam in men-of-war, 6,000f.,—Any remarkable improvement in the science of optics, the particular branch being left to the choice of competitors—the Bordin prize, 3,000f.,—The determination by experiment of the precise causes influencing the difference in the position between optical and photogenic foci, 3,000f.

Physical Sciences.

The best essay on the nervous system in fishes, with their comparative anatomy, 3,000f.,—The examination and nature of vegetable hybrids, their fecundity, and the possible perpetuity or non-perpetuity of their characteristics, 3,000f.,—The changes during germination in the constitution of tissues, and the examination of the matter of those tissues, 3,000f.,—The development and perpetuation of hybrid animals by artificial fecundation, 3,000f.

Medical Sciences.

The great Bréant prize of 100,000f. for the discovery of a specific for cholera; 4,000f. for the discovery of any active atmospheric agent causing or propagating epidemics,—The history and treatment of pellagra, 5,000f.,—The best mode of applying electricity to therapeutics, 5,000f.

Surgical Science.

On the preservation of members by preserving the periosteum, 20,000f. (10,000f. of this prize are contributed by the Emperor.)

Natural History.

The examination of the question of spontaneous generation, with the view of throwing a new light on the subject, 2,500f.,—How far vertebrate animals may be developed or changed by exterior agents, 2,500f.,—The distribution of the vessels of the latex in the organs of plants, and their connection with the lymphatic or spiral vessels, 3,000f.,—The anatomical and physiological history of coral and other zoophytes of the same family, 3,000f.,—The determination by anatomical research of the existence in plants of characteristics peculiar to the great natural families, 3,000f.

CULTURE OF THE OSIER WILLOW.

Having lately seen several inquiries respecting the osier willow and its culture, and being asked almost daily, "Do you think it will pay?" I have concluded to send you my experience of its cultivation. Three years ago this spring, after corn planting, I set two acres of the French osiers, placing them in rows three feet apart, at a distance of one foot from each other. The first year I cultivated and hoed the same, as corn, and many of the shoots attained the height of four feet. The next spring I cut them, but, having no machine for peeling, lost the crop, except a few used for sets. Last spring I cut and commenced peeling by hand, which I found rather an uphill business, and almost resolved to abandon their culture, if they must be peeled in that way. About this time a machine was invented for peeling willows. I immediately procured one, which worked to my entire satisfaction, and with it finished peeling my crop, which when ready for market, including some sold for sets, a little exceeded a ton. These I shipped to a commission merchant in New York, and received for them 110 dols. per ton. This year I have a much heavier crop. For an experiment I have weighed those cut from 12 stools, which amount to 18lb. I have found in peeling and drying they waste nearly one-half. The produce of an acre stands thus:—14,520 stools per acre, 1½lb. each, 21,780lb. Ready for market, 5½ tons, 110 dols. per ton, 60,500 dols.; cost of cutting, per acre, 600 dols.; cost of peeling

7 dols., per ton, 3,300 dols.; binding and taking to market, 5 dols., per ton, 2,700 dols.; total, 7,200 dols. Deducting expenses, this leaves a profit per acre of 533 dols. According to directions received at the time I planted, I have not cultivated mine since the first year, but think they should be cultivated once every spring, to loosen the soil and keep them free from weeds and grass. I am confident that any one who has suitable ground, and will bestow proper cultivation, can realize this amount from an acre of willows, perhaps more. After reading these facts I think no one can hesitate to answer the query, "Will it pay?" [The preceding article, from the American Agricultural Journal, the *Rural New Yorker*, contains some hints that have their value both for our landowners, and agriculturists, and even basket-makers themselves. While there are thousands of acres of land in each of the three divisions of the United Kingdom, eminently well suited to the cultivation of the osier willow, there is an enormous importation of the osier rods, from Belgium (chiefly) and other places abroad—whence the "white rods" are obtained ready peeled, and a profit paid abroad upon the industry consumed both in the cultivation and preparation of an article, the production of which is attended with no risk, and for which there is an ever ready and expanding demand. So much is this the case, that we are informed by a person in the trade, that "rods" are frequently extremely scarce and high priced, and yet the culture, it would appear, can yield a profit fairly competing with that of any other ordinary crop per acre, and one that may be grown where absolutely nothing else of any use can be produced. Independently of swampy land, of which we have still, unfortunately, a superabundance, there are several useful species of the willow that will thrive on moist unreclaimed peat.—Ed.]

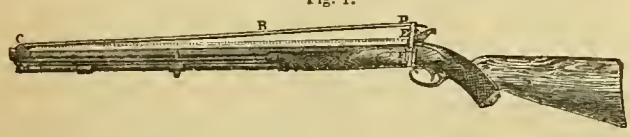
RECENT PATENTS.

SIGHT FOR FIRE-ARMS.

Charles Robertson, *Edinburgh.—Patent dated July* 25, 1861.

The improvements secured under these letters patent, relate to a new arrangement and construction of sights for fire-arms, for the purpose of taking a quicker and more certain aim than is attainable with those now in use. Under one modification of the invention, when applied to a single-barrelled rifle or fowling-piece, a moveable sight-bar is placed on the top of the barrel itself. This sight-bar consists of a bar, or rib, of steel, or other suitable metal or materials, which on the upper side is a level plane, nearly corresponding in appearance with the centre bar or rib at present used in double-barrelled rifles on which the sights are placed, with this exception, that there are no raised back sights, as these are, in the present invention, superseded by a movement of the sight-bar to be afterwards explained. On the under side this sight-bar is formed so as to fit and rest on the upper portions of the barrel, or it may be fixed upon a saddle-piece of the same metal, or some other suitable metal or material, formed so as to fit and rest on the barrel. This sight-bar is made to extend from the muzzle of the piece to the breech, or beyond it. It is attached by a hinge to the barrel near the muzzle, so as to be capable of being raised up from the barrel. The elevation at the breech end suitable for shooting at long distances may be attained by a vertical movement of the whole bar, or of the bar and saddle-piece from the hinged point. The accompanying engravings represent one mode of applying the sight-bar to a gun or rifle. Fig. 1 is an elevation

Fig. 1.



of a gun with the sight-bar raised to a position suited to a long range, the dotted line showing the sight-bar when resting on the barrel. Fig. 2 is an elevation showing the backward end of the sight-bar, and front view of the slide or elevator, which, however, may be arranged in various ways. Fig. 3 is a plan of the parts corresponding to fig. 2. Referring to the complete elevation of the gun, fig. 1, the muzzle end of the barrel, A, has hinged to it the sight-bar, B, which is made in the form of a thin, flat bar of steel, or other suitable material. In this modification the bar, B, extends the full length of the barrel, and slightly beyond the breech; when depressed it fits closely to the barrel, as shown by the dotted line. In the centre of the front end of the sight-bar is a small stud, C, or front sight, similar to that on an ordinary fowling-piece; at the rear end the centre is indicated by a small line or groove formed

Fig. 2.

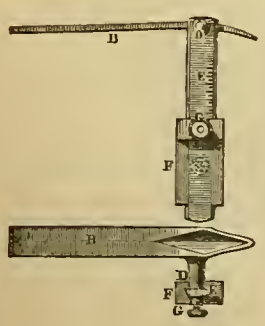


Fig. 3.

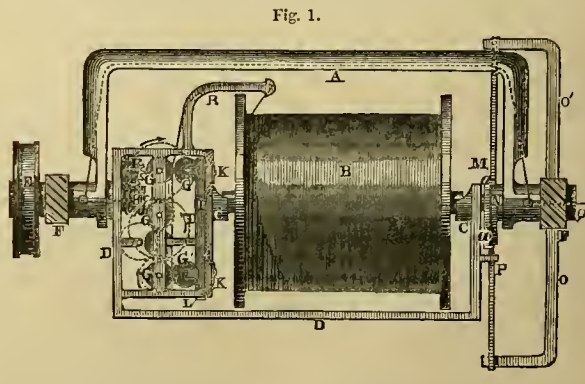
in the tail piece which is curved in a downward direction, as shown in fig. 2, so as to fit closely to the form of the piece, and a line or groove may be drawn from the groove in the tail piece to the front sight, as shown in fig. 3. In the present instance, this tail piece terminates a little beyond the breech, but for long ranges it may be prolonged and adjusted so as to exceed the view of the barrel. The sight-bar has formed on it, near the backward end, a laterally projecting part, D, which passes through a slot formed in the slide, E, (by means of which the sight-bar is elevated,) and is attached thereto by means of a screw, by which a lateral motion may be given to the bar. The slide, E, is bevelled at the edges, and moves up and down in the frame, F, which is fastened by a screw to the stock, and, if required, this part may be made to turn partially round to the horizontal position when the slide, E, is not in use. The slide, E, is graduated in the usual way, to show the necessary elevation of the sight-bar for a given range. The slide is fixed to any required elevation by means of the pinching screw, G. Or instead of this arrangement, the slide, D, may be slightly notched at one side to correspond to the lines of graduation, and the free end of a small blade spring made to fall into these notches. With this arrangement, when the slide is raised by the finger of the user, the spring gives an audible click as each indentation is passed, so that the sight may be adjusted to the required range by the ear, without the necessity of looking to the scale, which enables the marksman to keep his eye upon the mark or moving object at which he is about to fire, whilst in the act of raising the bar to the proper elevation. A slight pressure on the upper end of the slide, E, is sufficient to release it from the spring and restore it to the normal position. This improved sight is applicable also to various kinds of ordnance. In other modifications it may be convenient not to extend the sight-bar the whole length of the barrel, or to attach it to the muzzle by a hinge, in which case it would require to be jointed to the elevator, so as to be capable of adjustment to the proper angle, and secured to the stock by a pin, or other fastening, passing through the stock behind the breech, or some other convenient place. When used for double-barrelled pieces, the sight-bar may be placed between the barrels, upon, or in the place of the rib, or bar now in use for the sight, and may be attached and moved as before described, or other equivalent manner.

FLYERS FOR SPINNING.

James Dunn, *Preston.—Patent dated June* 18, 1861.

This invention has reference to improvements in machinery for slubbing, roving, spinning, twisting, and doubling cotton, and other fibrous substances, for which provisional protection was granted to the patentee on the 5th day of April, 1861, and consists in the introduction of drawing rollers, carried by a suitable frame, to the inside of the flyer which is mounted horizontally, the frame being suspended loosely from each internal extremity of the flyer. A full bobbin of the material to be operated upon, is placed upon the spindle, also inside the flyer, from which bobbin the material is unwound or drawn off by the action of the drawing rollers, to which the requisite motion is imparted from the neck of the flyer by means of an endless screw and worm wheel. From these rollers the material passes through the tubular neck of the flyer, and along the side thereof, which is either hollowed, or channelled, or solid, and furnished with guide eyes for that purpose, finally issuing through another tubular neck on the opposite end of the flyer, a double twist at each revolution of the flyer being consequently imparted to the material. If desired, the flyer itself may be dispensed with, in which case a single twist only will be imparted to the material at each revolu-

Fig. 1.



tion of the apparatus. In this second modification, the drawing rollers are carried in a rotatory frame, driven by a pulley fast on a hollow neck which forms the axis of rotation of the frame.

Fig. 1 of the accompanying engravings is a side elevation of one

modification of the improved apparatus for slubbing, roving, spinning, and twisting cotton, and other fibrous materials. Fig. 2 is a side elevation of a modified form of the apparatus, as applied to the process of doubling. Fig. 3 is an elevation of another form of apparatus for slubbing, roving, spinning, and twisting, wherein the flyer is dispensed with, and in which the frame, D, and drawing rollers are shown at right angles to that of fig. 1.

Fig. 2.

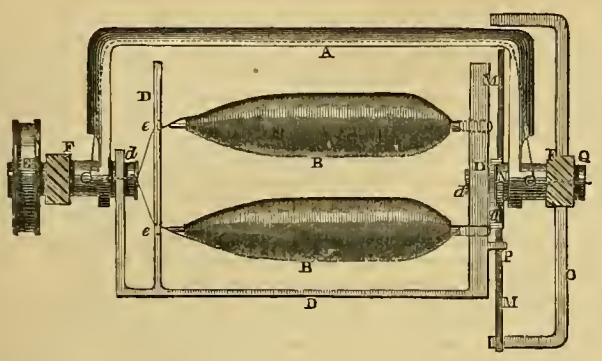
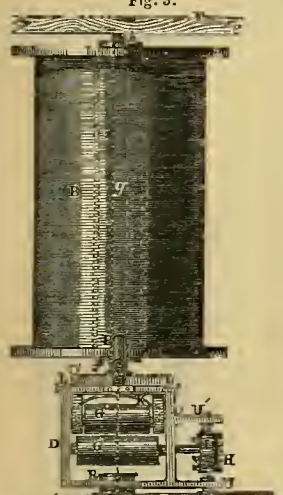


Fig. 3.



In fig. 1, A represents the flyer, and B the full roving or slubbing bobbin which is carried on a spindle or creel resting loosely in bearings, C, formed on the inner ends of the frame, N, which frame is suspended loosely from inside bosses formed at each end of the flyer. E, is the driving wharve or pulley fast on one end of the flyer, and F, are two fixed bars, or supports, carrying the bearings of the several flyers. The frame, N, carries near one end the series of drawing rollers, G, which are driven by a worm, H, on the inner boss of the flyer, A, this worm gearing into a worm wheel, I, from which motion is transmitted to the drawing rollers by suitable toothed gearing shown in dotted lines in the figure. The drawing rollers marked, G, are fluted, and those marked G^1, are plain rollers covered with leather as ordinarily used. These covered rollers are carried in a subordinate frame, D^1, which is fitted inside the frame, N, in such a manner as to admit of its being slid downwards therein a sufficient distance to separate the rollers of each pair for the purpose of allowing of the piecing of the ends of the thread or roving when broken. K, are springs which bear upon the moveable frame, D^1, and serve to maintain the rollers in contact when in operation. L, is thumb-screws for holding the frame, N^1, in its proper working position, which screws being slackened when the frame, N^1, requires to be moved. The suspended frame, *d*, is steadied and prevented from oscillating when the apparatus is in action by means of a rod or bar, M, which is provided with two contact pieces, *a*, bearing against the upper and under surfaces only of an eccentric, N, formed on one of the inside bosses of the flyer, and working in a recess formed at the guide frame at the centre of the bar, M. The end of the boss of the flyer beyond the eccentric, N, passes through the guide formed on the centre of the bar, M, so as to prevent any lateral motion of the bar, M, and allow it to vibrate vertically in a rectilinear direction only. To the fixed bearing bar, F, are fitted the stationary arms or stops, O, O^1. On a rotatory motion being imparted to the flyer, the eccentric, N, will cause the bar, M, to rise and fall once for every revolution of the flyer, bringing each end of the bar alternately into lateral contact with the upper and under arms or stops, O, O^1, and as the bar, M, slides through an eye, P, in the frame, N, it follows that as one or the other of the extremities of the bar, M, is always in contact with the stops, O and O^1, the frame, N, will always remain perfectly steady and free from lateral vibrations or oscillations. The object of imparting a reciprocating motion to the bar, M, is to allow of the free passage of the flyer past the ends of the bar, the motions of the bar being so timed as to cause it to move out of the way of the flyer at the proper periods. The bar, M, is shown in full lines, in fig. 1, as being in contact with the lower arm or stop, O, the arm of the flyer being in the act of passing the upper end of the bar, whilst the dotted lines represent the bar when moved upwards so as to be in contact with the upper stop, O^1, the flyer at that time passing the lower end of the bar. By this means, the frame, D, is held perfectly steady without any impediment being offered to the free rotation of the flyer. On motion being given to the flyer through the pulley, E, the rollers, G, are set in motion through the worm, H, and worm wheel, I, and draw the roving from off the full bobbin, B, through the guide arm, R, secured to the frame, D. A twist is imparted to the roving on its first entering the tubular neck of the flyer at H, and a second twist is given on its egress from the opposite end of the flyer at Q, when, by means of suitable appliances, it may be wound upon a bobbin, or formed into a cop, as required, the course of the thread or roving being the reverse of that in the ordinary system, namely, from the inside of the flyer to the outside thereof.

In the arrangement shown at fig. 2, adapted for effecting the operation of doubling, A is the flyer, B two cops of yarn to be doubled and twisted together, carried by pins secured to the frame, D, which is suspended loosely at each end from the inner bosses, *d*, of the flyer; F, are the bearings for the flyer, and E is the driving wharve or pulley. The threads are drawn from off the cops, B, by means of a pair of rollers situate at Q, not shown in the engraving, through the separate guide eyes, *e*, in the suspended frame, D. The two threads are doubled, and receive their first twist at Q, and after passing along one leg of the flyer, receive a second twist at G, on their egress therefrom. The same arrangement is here shown for steadying the frame, N, as that described in reference to fig. 1. The flyer in all cases may be either made with one leg hollow, as shown in the engravings, or it may be made with solid legs, having suitable guide eyes fitted thereon for the threads or rovings to pass through.

A modification of fig. 1 is shown at fig. 3, in which the flyer is dispensed with, a single twist only being imparted to the thread at each revolution of the apparatus. The full bobbin, B, is placed vertically in lieu of horizontally, and is carried upon a tin tube, *f*, supported by a creel peg, *g*, (shown in dotted lines) secured to the drawing roller frame, N. A centre pin, *h*, in the top of the tin tube, turns freely in a recess in the upper supporting or bearing rail, F. The lower rail, F^1, is provided with a bearing for carrying the tubular boss, R, of the frame, D, upon which boss is secured the driving wharve or pulley, E. G and G^1 are the several drawing rollers, those marked G being fluted, and carried in bearings in the frame, D, whilst those marked G^1 are plain and covered with leather, and are carried in bearings in the subordinate or adjustable portion, *d*, of the frame, N. The upper and lower rollers are kept in contact by means of springs, one of which is shown in fig. 3, at K, bearing upon moveable steps contained in slots in the adjustable frame, which steps bear upon the pivots or axes of the rollers. The pressure may be adjusted as required by means of the thumb set screws, L. S, is a stationary boss formed on the lower rail, F, through the centre of which boss passes the tubular boss or neck, R, of the frame, N. A friction pulley, T, carried by the vertical spindle, U, in the frame, D, bears against the boss, S, and when the frame, N, is rotated by the pulley, E, the friction pulley, T, receives a rotatory motion by travelling round the boss, S, which motion is imparted to the drawing rollers by means of the worm, H, on the spindle, U, and worm wheel, I, suitable toothed gearing being employed for transmitting this motion to the several drawing rollers. P is a tubular guide secured to the frame, D, through which the thread or roving passes as it is wound from off the bobbin, B. On imparting a rotatory motion to the frame, D, the rollers, G, G^1, will, by their rotation on their own axes, draw off the roving from the bobbin, which roving receives its twist on passing out through the tubular boss or neck, R, of the frame, D.

MACHINERY FOR DRESSING SLATE.

J. W. Greaves, *Carnarvon.—Patent dated May* 18, 1861.

The machinery or apparatus for dressing slates, introduced by the patentee, affords accommodation for two workmen at the same machine, thus producing double the amount of work hitherto accomplished in machines of this description. According to this invention, the cutter or cutters is or are mounted at a slight angle or inclination to the axial centre line of the main shaft of the machine upon a pair of holding discs or frames. The cutting edges of the cutter or cutters are in opposite directions, so that by imparting a circular reciprocating motion to the discs, they will alternately act upon and dress the edges of the slates, which are presented to them, upon stationary cutters or knives at each side of the machine.

Fig. 1 of the accompanying engravings is a side or end elevation of this improved double action slate dressing machine; and fig. 2 is a corresponding plan of the same. A is the main framing of the machine, and B are two knives or cutters mounted on the discs, C, fast on the shaft, N, the knives being at an angle with the shaft in place of being

parallel therewith. A reciprocating motion is imparted to the knives, B, by a crank or cranks at E, on the crank shaft, F, to which a rotatory motion is imparted by a strap and driving pulley, G, or by any other

Fig. 1.

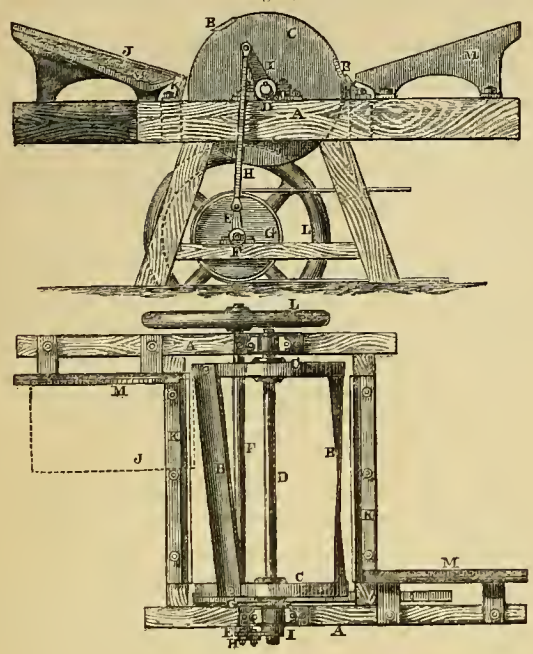


Fig. 2.

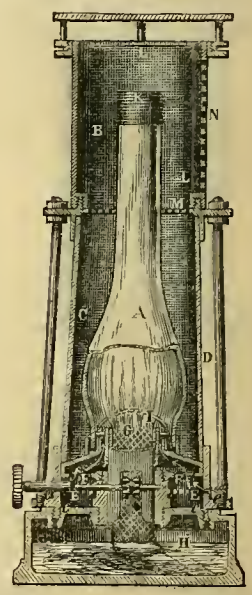
suitable contrivance. H is a connecting rod, serving to connect the rotating crank, E, with the longer and reciprocating crank, I, fast on the cutter shaft, D. The rotation of the crank, E, imparts the desired oscillating or circular reciprocatory motion to the cutters, which have their cutting edges in opposite directions, and act alternately upon slates, as at J, laid on the two stationary cutters, K. L is a fly wheel fast on the driving shaft, F, and M are the gauges for determining the proper dimensions of the slates. It is obvious that in lieu of two reciprocating cutters one such cutter only might be employed, each edge acting alternately as a cutting edge.

SAFETY LAMPS.

THOMAS YOUNG HALL, *Newcastle-upon-Tyne.—Patent dated April* 23, 1861.

THE object of these improvements in miners' safety lamps, is to render them safer, and so as to impart a better light than has hitherto been obtained from lamps of this description; the improvements are also applicable to domestic fire-grates, stoves, and furnaces. According to the first part of this invention it is proposed to apply to a miner's safety lamp a wick and burner adapted for the combustion of petroleum, paraffin, or other hydro-carbons, in lieu of the ordinary oil lamps, and to apply a suitable chimney to such burners, whereby a very superior and economical light is obtained. This superiority in the illuminating powers of the lamp enables a considerably finer gauze to be employed; and for extra safety and strength, when thought necessary, will admit of two or more gauzes being used, placed one within the other, without diminishing the light to an inconvenient extent, and consequently the lamp is rendered much safer than the ordinary lamps, where, on account of the dimness of the light, the gauze is required to be of a coarse mesh in order that it may be obscured as little as possible. The chimney may be made either in one length, its upper part projecting inside the upper chamber of the lamp, or it may be made in two parts, the upper part being secured inside the upper part of the lamp, and so fitted that when the parts are united they will form one chimney. The wire gauze in the lower part of the lamp is surrounded or protected by a glass cylinder which prevents the dust from coming into contact with the gauze, and keeps the lamp clean. The air for supporting combustion may either impinge on the flame at the top of the wick or wicks in a cold state, or it may be first heated as preferred; in the former case it will enter through suitable adjustable perforations in the lower part of the lamp, and after passing through a series of gauzes into a vault or chamber placed above the liquid pan, impinges on the flame close to the wick, and passes up the chimney without entering the space in the body of the lamp between the ordinary gauze cylinder and the chimney. The chimney or shaft admits of expansion when the air is heated, and the gauze cylinder being made to fit closely against a solid flange or collar, or against the chimney surrounding the burner, the hot air is thrown out at the top; or, if hot air be preferred, it will enter by a series of perforations at the top of the lower half of the lamp, and will pass down between the outside of the chimney and the inside of the gauze cylinder or cylinders, and will then enter beneath the burner, where a double or single cap, dome, or arch perforated with small holes causes the principal part of the air to impinge upon the flame at the top of the wick as before, or both hot and cold air may be used together. Suitable adjustable air holes are formed in the upper part of the lamp for the purpose of ventilating or allowing the heated air or smoke (if any) to escape therefrom. The top of the chimney of the lamp is provided with a double cap or cover of gauze, and is surrounded externally or internally with wire gauze. The same principle is adopted at the bottom of the lamp, which bottom is removable from the top, and may be replaced by another liquid pan when the first has become empty, so as to maintain a constant supply of liquid to the wick; for this purpose double locks are provided, one at the bottom and one near the top. An additional guard or shield surrounds the whole outside of the upper part of the lamp, composed either of glass or of a cylinder of metal perforated near the top on one side only so as to protect the lamp against any current.

The subjoined engraving illustrates the first part of this invention, and represents a vertical section of one modification of this improved safety lamp, adapted to the burning of petroleum, paraffin, or other hydro-carbon, in lieu of ordinary oil (as hitherto employed in lamps of this class) and supplied with cold air. A is the chimney of the lamp, the top of which projects into the upper chamber or safety part of the lamp, B; C is the wire gauze in the lower part of the lamp; it may be made of a much finer mesh than heretofore, and of one, two, or more thicknesses, as desired; D is a glass cylinder which surrounds and protects the gauze from dust; at E are a series of adjustable air apertures, the orifices being regulated or adjusted by a similarly perforated ring, *e*, made to turn round in front of and so close or partially close the apertures, E, or in lieu of this ring any other simple contrivance may be adopted for the purpose of regulating the inlet of the air. Immediately inside the apertures, E, is a wire gauze, *f*, or, if desired, two or more thicknesses of such gauze may be used, forming the sides of the air chamber, F, situate beneath the burner, G, and above the liquid or oil vessel, H. The air on entering this chamber, F, ascends as shown by the arrows into the hood or dome, I, and impinges directly upon the top of the wick, as shown; K is the wire gauze can or cover placed on the top of the chimney, A, and L is a double wire gauze which surrounds and encloses the upper part of the lamp; the gauze, C, in the lower part of the lamp fits closely at its upper end against the perforated collar or flange, M, surrounding the chimney, which divides the upper from the lower part of the lamp; this collar or flange may, however, be dispensed with if desired; N, is the shield which surrounds the gauze, L, at the safety part of the lamp, and is perforated on one side with holes to allow of the egress of the hot air and products of combustion, whilst the other side is left solid, so as to protect the upper part of the lamp from draughts or currents of air by being turned toward such draughts. This shield may in ordinary cases be dispensed with, and is only required in the presence of highly dangerous gases, so as to shield them in a great measure from the upper or safety chamber of the lamp.



The lamp above described may, if found desirable, be provided with a suitable gas burner in lieu of the wick, and may be made to burn any illuminating gas or gases supplied thereto, either from portable receivers or otherwise, as preferred. The lamps may, if desired, be provided with dioptric lenses in lieu of the outer glass cylinder in order to intensify the light, and to throw it to great distances, so that one lamp will serve to light up several workmen or workings in lieu of having a lamp in each. When it is requisite to penetrate into very dangerous gases, where there is little or no air, a case or jacket partly of glass to admit light through, and made air-tight, may enclose the whole safety lamp, the whole or only the glass portion being surrounded or lined if thought necessary with gauze, and the fresh air in

this case will then be supplied by suitable air pipes in connection with a receiver to circulate air freely in and out of the lamp and into the air-tight casing surrounding the miner, enabling him to penetrate safely the dangerous gas or gases for short or long distances when such is needed.

The lamp may be provided with one or more wicks of different sizes, the smaller ones being distributed in such a manner as to admit of the access of cold or heated air through ducts terminating at the point where the flame springs from the wick. Various kinds of wicks may be used, composed either of cotton alone, or of cotton intermixed with asbestos. By adapting this lamp so as to hang from a stand or supporting bar it may be moved or adjusted by the miners to suit the work without leaving their places.

The second part of this invention relates to the consumption of smoke in ordinary fire-grates, underground or other furnaces or stoves. In the case of furnaces where large chimneys or upcast shafts are used to carry off the products of combustion, the fire is partitioned off into compartments, each compartment being dome-shaped transversely with air holes at the side for the admission of air upon the fire on one or both sides of the outer arch. These fires can be stoked separately, by which means combustion of the gases is ensured, and smoke prevented. The furnace is widened near the chimney or shaft to allow of the expansion of the heated air. In underground furnaces where dangerous gases are likely to come upon the fire, a double gauze to admit air, or air and gas, is fixed behind the furnace, so that the air comes through it, and in case there should be any foul gas in the fire, the explosive gas may be taken up the chimney or upcast shaft by the current. A safety lamp is placed between the double gauze which indicates the presence of dangerous gases to the fireman in charge of the furnace.

SIGNALS FOR RAILWAYS.

JOSEPH HOLLAND, *of Manchester, and* GEORGE OKELL, *of Ashton-under-Lyne.—Patent dated September* 7, 1861.

THE object of this invention is to enable an engine or train to give an alarm or signal at any required place on arriving at or passing any given point on a railway. The invention consists in arranging a treadle or treadles at any given point on the line, so that the flanges of the wheels of the passing train, or some suitable projection from the train may, in passing, depress the same, a spring being employed for raising the treadle again after the train has passed. This motion of the treadle is made to work a pair of bellows, a pump, or other contrivance by which air can be forced past a valve or valves (which prevent it from returning) into and along a pipe extending from the apparatus to the beam where the alarm or signal is to be given, the air forced into the pipe being made to sound one or more whistles placed at the end of the pipe, or at branches from it, so as to give notice at one or more stations that an engine or train has passed the point where the treadle or treadles are fixed.

Fig 1.

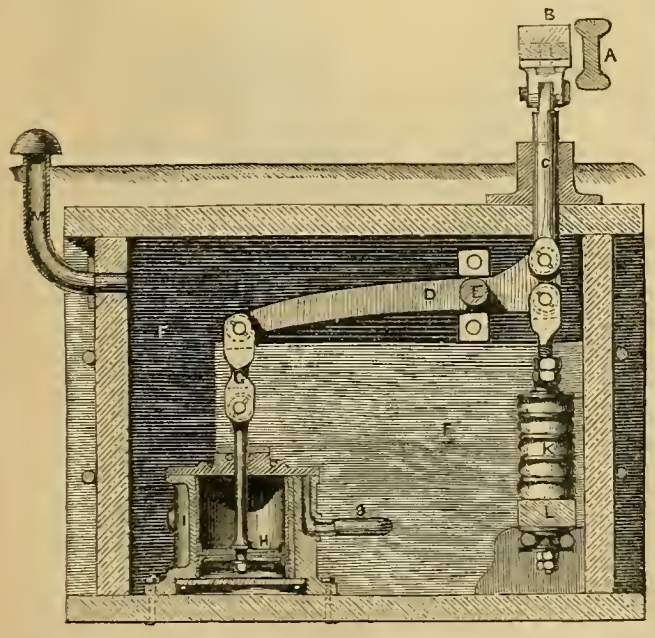
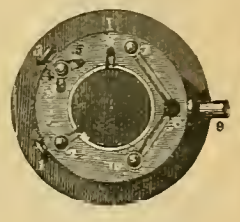


Fig. 1 of the annexed engravings is a longitudinal section of this apparatus as applied to a railway. A is one of the rails, and B a lever or treadle situate on the inner side thereof, so as to be acted upon by the flanges of the facing wheels. To the under side of this treadle is jointed a vertical rod or link, C, the lower end of which is jointed to one end of a lever, D, working on a fulcrum at E, inside the water-tight box, F. The opposite end of this lever is connected by a short link, G, with the rod of a piston, H, working inside the air-pump cylinder, I, (a detached plan of which with the cover removed is shown at fig. 2.) K is an india rubber spring connected to the shorter end of the lever, and resting upon the fixed support, L, its object being to react upon the lever after the passage of the wheels over the treadle, and thereby restore the several parts to their original position again. M is an air-pipe for admitting air to the interior of the box, F, the top of the pipe being covered or protected by a cap to prevent the entrance of wet or dirt therein. The interior of the cylinder is lined with brass, or other non-corrosive metal, and the valves for regulating the inlet and outlet of the air consist simply of vulcanised india rubber balls. The passages for the air are represented in fig. 2. The air inlet to the upper side of the piston is at 1, the air ascends the passage, and lifts the ball valve, 2, and then enters the cylinder by the channel cut in the top flange. The inlet for air to the lower side of piston is at 3, the air lifts the ball, 4, passes along the upper channels, and descends the two vertical passages, 5, 5, to the bottom of the cylinder. The outlet for the air from the top side of the piston is by a channel leading to a vertical passage, 6, the air descending, and then ascending up the adjoining passage, lifting the ball, 7, whence it passes along an upper channel, leading to the vertical passage, 8, which conducts it direct into the pipe, 9, in connection with the whistle. The air, when being expelled from the bottom side of the piston, ascends directly, and lifts the ball, 10, passing along the upper channel leading to the passage, 8, and so on to the pipe 9. At each passage of a train or engine the piston will make a double stroke, being brought down again by the spring, and a certain volume of air will consequently be forced along the pipe, 9, and through the whistle or whistles at each stroke, thus giving the distinct signals or sounds each time the apparatus is acted upon at any distant station or point along the line.

Fig. 2.



GAS REGULATOR.

J. H. JOHNSON, *London and Glasgow*, (HENRI GIROND, *Paris.*) *Patent dated May* 30, 1861.

THIS invention relates to a peculiar construction and arrangement of self-acting apparatus for regulating the pressure of gas in mains or service pipes, and consists in the use of two separate apparatus working in conjunction with each other, the one piece of apparatus being placed in some central position in the locality supplied by the works, whilst the other is situate at the place where the gas is manufactured. The first-mentioned piece of apparatus consists of a float or pressure gauge or indicator, the needles of which are so constructed that one of their branches dips into one or other of two vessels containing mercury, or establishes in any equivalent manner an electric contact whenever the pressure varies in the slightest degree from its regulated or desired amount. Two conducting wires connected severally to the vessels of mercury or contact surfaces, as the case may be, extend to the gas works, and the needle of the indicator being in communication with one of the poles of a battery, the other pole of which is in connection with the earth, it follows that each time the pressure varies one of the branches of the needles establishes an electric communication with the gas works. The second piece of apparatus placed at the gas works consists of a hydraulic valve or regulator placed on the mouth of the main, which conducts the gas from the gas-holder, such valve being opened or closed by an arrangement of wheelwork actuated by a weight and duplex gearing. Two electro-magnets, attached one to each wire, are so adjusted in the apparatus as to act upon the starting or reversing lever of the wheelwork, and according as one or the other of these magnets is excited, the lever will be brought into two opposite positions, or will remain in a central position when both magnets are unexcited, and the valve will be either elevated, depressed, or held stationary accordingly. By a slight modification of the pressure indicator it may be transformed into a commutator, in which case one conducting wire only, in place of two, would be required.

Fig. 1 of the accompanying engravings is an elevation, partly in section, of the apparatus which is intended to be established at the place

where the gas is manufactured; it consists of a hydraulic valve and equilibrium bell. Fig. 2 is a sectional elevation of the apparatus, which is to be placed in some central position in the locality supplied by the works. It consists of a pressure indicator and regulator, which regulates by the aid of electricity the position of the hydraulic valve at the works. Fig. 3 is a vertical section of a modified form of equilibrium bell capable of moving the valve by the return of the gas itself, thereby dispensing with wheelwork and electric agency, as hereinafter described. Figs. 4 and 5 represent respectively a front and side elevation of the wheelwork for working the regulating or supply valve, drawn to a larger scale than in the general view. Fig. 6 represents a vertical sectional view of the apparatus, showing the gas pressure indicators and the reversing contacts, as well as the three-way cock which receives the return gas to a larger scale than in fig. 2. Figs. 7 and 8 represent respectively a front and side elevation of the reversing contact mechanism drawn to a larger scale than in fig. 6. So soon as the valve of the gasometer is opened, the gas will arrive by the pipe, A, fig. 1, underneath the inverted vessel or chamber, B, which is supported at four points in its circumference in the water tank, C. From this chamber the gas passes inside the suspended bell, D, in order to become distributed through the mains by passing down the pipe, E.

FIG 2.

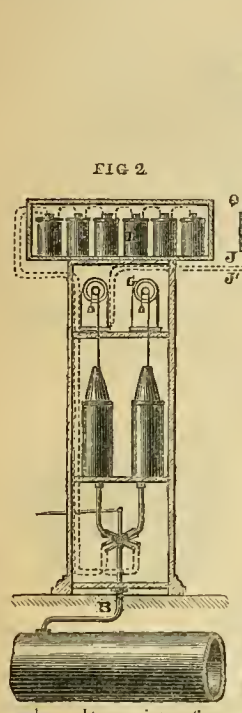


FIG.1.

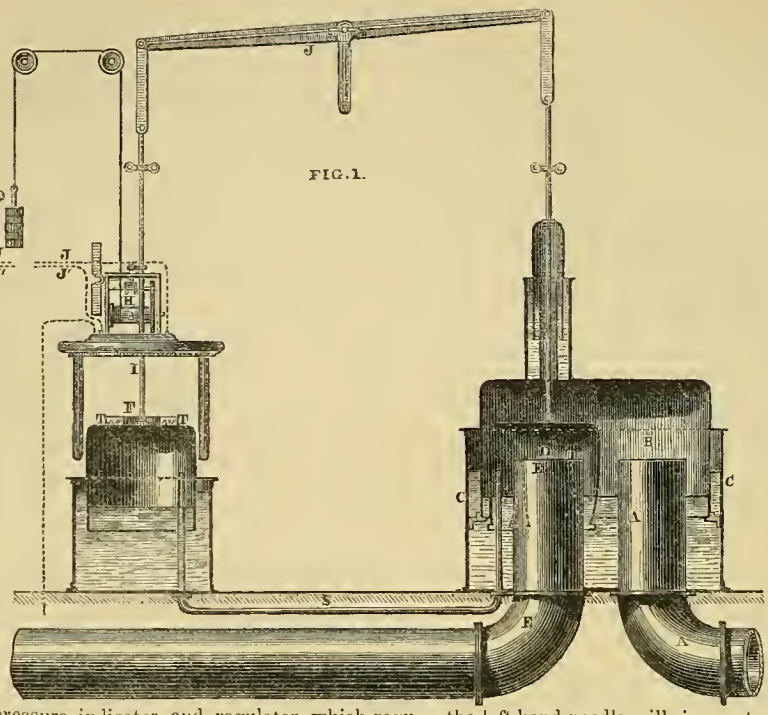
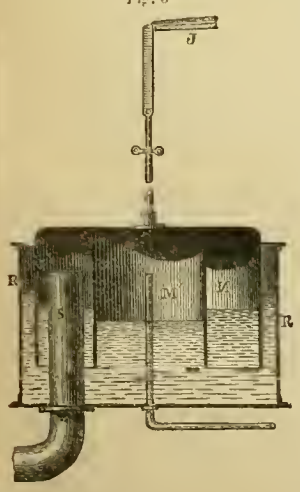
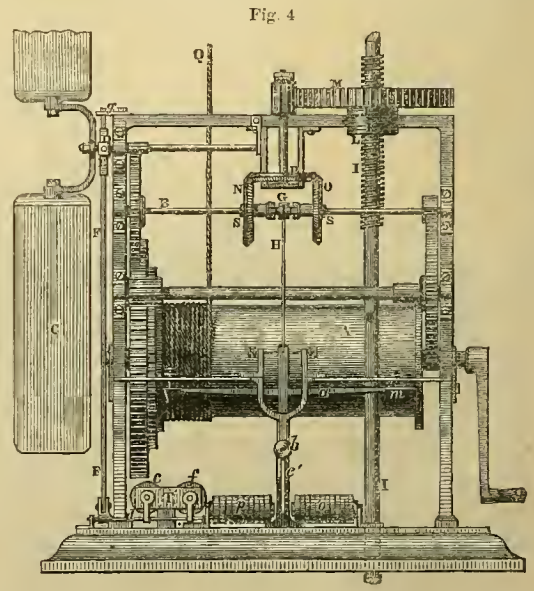


Fig. 3



The bell, D, is a cylindrical vessel closed at its upper end, and suspended from an oscillating beam or lever over head. When it is lowered by the movement of the lever, so as to rest upon the pipe, E, it establishes a hydraulic joint or seal, when the gas will no longer pass into the mains; and in order to prevent the entrance of air through the aperture in the vessel, B, through which the rod of the bell, D, works, this rod is itself provided with a water joint or seal, as shewn. When the bell, D, is elevated the gas escapes by the triangular openings made therein, the aggregate area of which should be equal to the area of the mouth of the service main. In the locality where the consumption is greatest, a small pipe of not less than one inch bore (the diameter of the bore being greater in proportion to the length of the pipe) is connected to the main. This pipe extends to the gas manufactory, and is in communication with an indicator, F, when the gas remains in a stagnant condition or state of rest, so that any variation of pressure in the locality supplied is instantly indicated at the works by a species of concussion or commotion in the column of gas in the pipe, but unattended by any great displacement. The float of the indicator thus receives a slight movement, which is transmitted to the pulley of a reverser, G, placed above it. This pulley carries two needles or indicators, which communicate with the two poles of the battery, L, and slide over a metallic dial, which is divided into two semicircles insulated from each other by a thin strip of ivory. A conducting wire connects the upper semicircle and the wheelwork, H, forming the return wire, whilst the lower semicircle communicates with the earth. The wheelwork is provided with a lever actuating a bevel wheel reversing gear which drives a wheel, of which the nut of the screw forms the pivot, so that this wheel turns first in one direction and then in the contrary direction according to the position of the bevel gearing, which is determined by the position assumed by the lever under the influence of two electro-magnets. When the gas in the locality to be lighted is at the proper pressure, the two needles of the reverser rest upon the strip of ivory, in which position the apparatus will remain at rest. If the indicator of the pressure of the return gas in the small pipe descends, the left-hand needle will rise on to the upper semicircle, and the right-hand needle will descend on to the lower semicircle, thereby closing the circuit. The current of electricity now elevates a detent, which arrests the fly wheel of the gearing or wheelwork, and at the same time so acts upon the reversing gear as to cause the screw spindle to descend and open the gas valve. If, on the other hand, the indicator rises, the reversing gear is acted upon in the contrary direction, and the gas valve is closed. Should the return pipe be extended to the gas works, a

Fig. 4

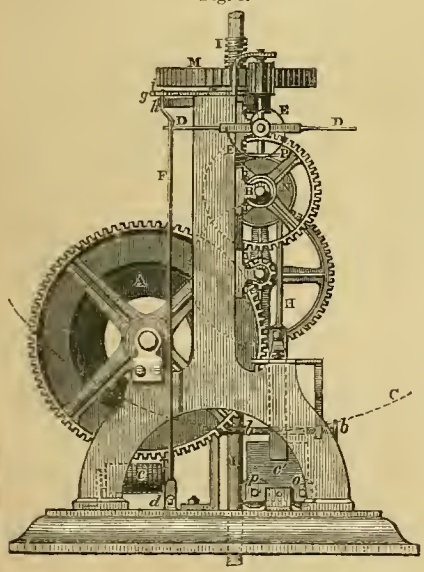


Daniell's battery of six cells may be used; but this number should be augmented if, for the purpose of reducing the length of the pipe, the indicators and their accessories be situate in the locality to be lighted; for, in that case, the wire will be carried to the gas works, and connected to the gearing placed by the side of the gas exit valve. It is convenient

to adopt this arrangement in order to have a more rapid transmission of the indications than could be obtained from the gas when the distance between the locality lighted and the works is considerable. When the return pipe is used extending from the centre of the locality lighted to the gas works, the wheelwork or gearing and electric current may be both dispensed with, the gas valve, D, being then actuated directly by the return gas itself. For that purpose the slight modification of the equilibrium bell, M, shown in fig. 3, may be adopted, but this will entail the use of a return pipe, S, of five inches bore, which increases the expense of the apparatus.

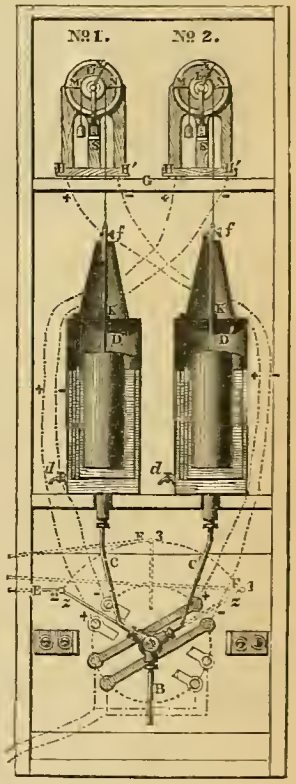
The wheelwork, H, in fig. 1, which is illustrated by enlarged elevations at right angles to each other, in figs. 4 and 5, is driven by a weight acting directly upon the drum or barrel, A. The movement of this barrel is transmitted by a train of toothed wheels and intermediate shaft to the spindle, B, and thence to the fly or fan wheel, C, the speed of which may be at the rate of one half to two revolutions per second, as required. Upon the axis of the fly wheel is placed with very slight friction the rod, D, connected to this axis by a spring, E, and serving to stop the wheelwork, when on turning with the fly wheel it encounters the rod, F. The fly wheel will then make a quarter or a half backward revolution, which movement is necessary for disengaging the sliding reversing clutch, G, and holding it in a position suitable for receiving the impulse imparted to it by the rod, H, at the moment of the passage of the electric current. The rod, F, works on the axis, *d*, which carries a bar of soft iron, T, attracted by the electro-magnets, *c* and *f*. The upper end of the rod, F, slides freely in a slot in the piece *g*, which limits its forward and backward movement. The spring, *h*, tends constantly to bring back the rod, F, against the pivot, *i*, so soon as the electric current ceases its action. The screw spindle, I, is connected at its lower end with the equilibrium bell, M, fig. 1, and at its upper extremity with the balance lever of the gas valve or regulator, D, in such a manner as to be incapable of turning, and the nut, J, of the screw is fitted to turn freely in a suitable opening in the frame, being maintained therein by a shoulder placed above it, and by a nut, K, and counter-nut, L, below it. Upon the shoulder is fitted a stop which serves to ensure the rotation of the nut with the wheel, M. The spindle, B, carries two bevel wheels, N, O, shown more clearly in the enlarged detail (fig. 4), both of which gear into the bevel wheel, P. The wheels, N and O, are both loose upon the spindle, B, but either of them may be coupled therewith by bringing the clutch, G, in contact with one or the other of them. This clutch slides freely along a feather on the spindle, and consequently turns with it. It is provided with suitable teeth or projections, R, on each side, which interlock into corresponding recesses or notches formed in the bosses of the wheels, N and O, thereby causing one or other of these wheels to be carried round by and rotate in the direction of the spindle, B. The two shoulders or collars, S, serve to prevent the wheels from coming out of gear. By this arrangement the wheel, P, will be rotated in either direction according to the position of the clutch, G, and by transmitting its motion to the wheel, M, and nut, J, will cause the rod or screw spindle, I, to rise or fall accordingly. The movement of the clutch, G, is effected by the rod, H, which works on the spindle, *b*, and is provided at its lower end with a permanent steel magnet, c^1, and is maintained in a vertical position by means of the springs, *l*, *m*, carried on the ends of the cross bar or arm, *a*, fixed to the rod, H. Supposing a positive electric current to be passing through the electro-magnets, *c*, *f*, the rod, F, by being drawn back will release the stop, D, when the wheelwork will be set in motion by the weight and cord attached to the barrel, A. At the same time the electro-magnets, *p*, *o*, will become excited, and will move the permanent magnet, c^1, to the right, for example, which motion, by imparting a corresponding movement to the rod, H, will cause the clutch, G, to be moved towards the left or bevel wheel, N, which will be set in motion, and will rotate the wheels, P and M, in such a direction as to cause the screw spindle or rod, I, to ascend. Should a negative current pass through the electro-magnets, the magnet, c^1, will be moved to the left, and the clutch, by bringing the bevel wheel, O, into action, will reverse the motion of the wheels, P and M, and will cause the spindle, I, to descend. The rod, F, will in both cases be acted upon as the plate or armature, T, consists simply of a piece of soft iron.

Fig. 5.



It now remains to describe the pressure indicators and reversors, shown in fig. 2, and in enlarged elevations in figs 6, 7, and 8. As in nearly all gas manufactories the gas is supplied at two different pressures during the night, it will be advisable to have two separate indicators, into either of which the gas and electric current can be readily directed. For this purpose a suitable chamber or box is used, in the lower compartment of which is securely fitted a three-way cock, A, fig. 6, which receives the return gas by the branch, B, and directs it by the branches, C, c^1, to one or the other of the two small pressure indicators, D, D^1; according as the rod, E, fixed to the key, Z, of the cock is in the positions shown in dotted lines at 1, or 2, and if it be in the central position, 3, the gas is shut off entirely. Upon a prolongation of the plug of the cock, A, is fitted a wooden disc, F, turning freely with it in a circular aperture in the back of the case, and carrying two copper strips or blades, which form a communication for directing the electric current of the battery alternately to either of the two contacts, Nos. 1 and 2, situate in the upper compartment of the case; and in front and side elevations, to an enlarged scale, in figs. 7 and 8 respectively. This communication with the reverse contacts is effected through the copper plates, which form the feet of the contact apparatus, H, H^1, communicating also with the battery, whilst the plates, J, J^1, on the opposite side of the apparatus, communicate with the wheelwork for actuating the gas valve.

Fig. 6.

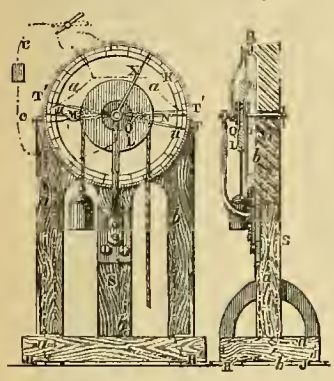


In the engravings the gas is supposed to be entering the indicator, D, and the electric current to be passing through the first contact apparatus, No 1, placed above it. If the handle, Z, and key of the cock, A, be brought to the position, A, E^1, the gas and the electric current will simultaneously change their course, the one being directed into the indicator, D^1, and the other passed through the contact, No. 2. On bringing the key of the cock into the central position, A, E^3, the gas will be entirely shut off, and the electric circuit will be interrupted. Upon each float of the indicators is fixed rigidly a vertical rod or spindle, which slides freely through a hole made in each cover at K. On the upper end of each rod is a headed pin, round which is wound a cord, which actuates the contact mechanism above, provision being made for adjusting the needles, M and N, to the position indicated by zero when the floats are acted upon by the proper gas pressure, or when it is desired to vary the pressure. The pulleys, L, of the contacts, and by which they are actuated, are composed of ivory or other non-conducting material, and its axis is made in two parts, as shown in fig. 8, each part communicating through its bearings or supports with one of the wires of the battery. For this purpose the copper plates upon which these bearings or supports are fixed are each in communication with the plates, H, H^1; from each half of the axis the current passes through the needles The needle, M, is for this purpose fixed to the collar or flange, P, by means of a piece of ivory, and it is connected to the collar, Q, by two screws which are not in contact with the collar, P. These two needles are provided at their extremities with small platinum points, which, when the pulley turns on its axis, rub over the surface of the copper circle, R, secured by screws to the support, S. In order to render this friction as slight as possible, two adjusting screws are tapped into the pulley, and cause the needles to bear upon the circle with the exact amount of friction necessary. This circle has four saw cuts made in it at the points, T and T^1, which cuts are filled with slips of ivory smoothed off flush with the surface, so as to offer no resistance to the passage of the needle points over them. The two small sections, *u*, of the circle are in communication with each other by means of a wire, *a*, which extends also to the plate, J, and thence to the wheel-work, whence it returns to the plate, J^1, which is itself in communication with the lower portion of the circle by the

wire, *b*. The upper portion of the circle, R, may be placed in communication at will, either with the wire, *a*, or with another wire, *c*, in connection with an alarm or signal bell, and thence returning to the lower portion of the circle.

In order to regulate the working of the contacts, it is necessary, first, to shut the cock, A, by bringing the key into the vertical position, A, E^3; the two cocks, *d*, of the indicators over them are then opened, when the floats will descend to the point marked zero. By winding up the cord of the float rod round the pin, *f*, the right-hand needle will descend to the numbered graduation or division in the lower part of the circle, which corresponds to the amount of pressure it is desired to maintain. The moveable needle, X, is adjusted by hand to the zero on the right of the dial. This needle, when the apparatus is in action, serves to indicate the pressure under which the apparatus is working; the first indicator may thus be adjusted to one degree of pressure, and the second indicator to another degree of pressure. The whole having been thus adjusted, and the upper portion of the circle in communication with the wire passing through the two small sections, *u*, if the key of the cock be brought in to the position, A, E^1, the return gas will enter into the indicator, D, and will raise its float, the pulley, L, of the corresponding coutact, No. 1, above it is turned slightly, and the needles will approach the horizontal line drawn across the diameter of the circle, R. Supposing the pressure of the return gas be lower than is desired, as the right-hand needle touches the lower portion of the circle, and the left-hand needle touches the upper portion of the circle, the circuit will be established. A negative current will pass through the wire to the wheelwork, which effects the further opening of the gas valve. The pressure in the locality will thus be increased, and a corresponding increase of pressure will be imparted to the return gas, which causes the pulley to again turn from right to left, until the needles are brought into a horizontal position, when by one of the needles resting upon the slip of insulating medium inserted into the saw cut in the circle above referred to, the apparatus will remain at rest. If, on the contrary, the pressure becomes too great, the right hand needle will move into the section, *u*, whilst the left-hand needle will come in contact with the lower portion of the circle, the circuit will be again established, and a positive current directed through the wheelwork, which closes, or partially closes the gas valve. If the communication between the circle, R, and the small sections or segments, *u*, be interrupted, and communication established with the conducting wire of the electric bell by means of an ordinary commutator, Y, should any change of pressure by any chance take place beyond the powers of the action of the wheelwork, the apparatus will cease to operate, and the bell being sounded will call the attention of the attendants or manager of the works Thus by these arrangements the regulating of the night pressure is effected simply by bringing the lever or key Z (figure 6) of the three-way cock into the position A, E^1; and if the pressure is to be instantly altered, this is effected by reversing the lever, and bringing it into the position, A, E^2; and in the morning at those works which do not supply gas during the daytime, the lever is brought into the position, A, E^3. In order that the wheelwork may operate with a regular speed, and produce the same amount of motion in the same space of time in the gas valve, it is necessary that this valve be maintained in a perfect state of equilibrium, which is accomplished in the following manner:—A small bell, M, (fig. 1,) of a cylindrical form like the valve, D, and of the same diameter, is fixed to the bottom of the screw spindle, I, of the wheelwork. The gas which is delivered in the locality under various pressures, and which exerts upon the valve, D, a variable effect from below upwards acts in a similar manner upon the bell, M, into which it is directed by the small pipe, S. The parts being all disposed with a view to the preservation of the equilibrium, it is simply necessary to apply a weight to one side or the other of the centre of the lever or beam, J; the annular space, T, formed on the equilibrium bell is intended for the reception of shot for this purpose. In works where several gasometers are employed, it is necessary to attach to the right limb of the beam or lever a small plate, which is destined to receive the particular weights required by each of the gasometers as they are successively brought into use. In order to allow for the variation in the weight of the moving parts arising from their different degrees of immersion in the water, it is simply necessary to place vertically in a vessel filled with water two rolls of metal of the thickness and form of the immersed cylinder; these rolls are attached to the extremities of the beam or lever. The modified form of equilibrium bell herein before referred to consists in placing round the equilibrium bell, M, shown in Fig. 3, a concentric bell, N, and in correspondingly increasing the diameter of the outer vessel or tank, R^1, and to enlarge the diameter of the return pipe, and to cause it to open into the annular space surrounding the inner bell, as shown. If a sufficient weight be now placed upon the bell, N, to balance any pressure of the return gas, it is obvious that if this pressure varies, the gas valve will be raised or lowered until the original pressure be re-established. The wheelwork and electricity may, under such circumstances, be dispensed with, but it will be necessary in order to obtain perfect accuracy that the equilibrium be perfect, and for that purpose it will be advisable to suspend the balance lever or beam upon knife edges at its working centres or points.

Fig. 7. Fig. 8.



LAW REPORTS.

Manufacture of Gas: Hills *v.* Evans.—Infringement.—Appeal.—In continuation of this report from our last, on resuming the argument, the short question was, whether Mr Hill's invention for improvements in the manufacture of gas was anticipated—that is to say, not new—by reason of the specifications of Mr Croll and Mr Laming, under letters patent previously granted to them respectively. The judgment of the Court of Exchequer determined this question in favour of the plaintiff, and established the novelty of his invention, as against the Loudon Gaslight Company, subject to an appeal to the Court of Exchequer Chamber. No appeal was prosecuted in that action; and upon the present case being opened in the month of December last, the Lord Chancellor directed the case to stand over for further hearing, upon which Mr Evans was first to bring before the Court all such questions and points of law as the London Gaslight Company might have brought before the Court of Error on the appeal at law in the action of "Hills *v* the London Gaslight Company," if such appeal had been prosecuted. The Lord Chancellor said that the object of the suit in Chancery was to obtain an injunction to restrain the defendants from any infringement of the patent of the plaintiff for the purifying of gas. Now this Court never granted a perpetual injunction until the title of the plaintiff had been finally established at law. It was said in the present case that by a decision at law, and an agreement between the plaintiff and some of the defendants, the title of the plaintiff had been permanently established, and that such right had been admitted and allowed by the defendant Evans, but he (the Lord Chancellor) was of opinion that Evans was not bound by the agreement, and would therefore under ordinary circumstances have been entitled to prosecute the appeal to the Exchequer Chamber or to bring a new action. This Court, however, now having authority to try the question itself, had determined so to do, and the parties had assented to such a course. The arguments had proceeded in this Court in precisely the same manner as if the validity of the plaintiff's patent were being tried in an action at law. After having considered the matter very much during the four days' argument, he (the Lord Chancellor) had come to the conclusion that the plaintiff's patent was good and valid at law. The construction to be placed upon the specifications of patents like the construction of other written instruments, belonged to the Court, but the explanation of the technical terms used in the specifications were by law deemed matters of fact to be decided by a jury upon the evidence adduced before them. Moreover, the directions to the jury by a Judge respecting the construction of the other portions of the specifications must be contingent upon the meaning placed by the jury upon such technical terms, and, in addition, the drawing a comparison between two specifications exclusively belonged to a jury. Under such circumstances, if the matter had gone by way of appeal to the Court of Exchequer Chamber in error, the Judges must have held that the question was one of fact, which had already been determined by a jury, and not one of law, over which they had jurisdiction. The case had been argued before him (the Lord Chancellor) as if it were before the Exchequer Chamber, and for the reasons above stated the judgment must have been in favour of the plaintiff. His judgment, however, would not rest upon that ground alone, for he had allowed the question whether the matters in the specification of the plaintiff's patent had not been made *publici juris* by specifications of patents anterior to the patent of the plaintiff. His Lordship then went most carefully through the various prior specifications referred to in the arguments, and, after commenting upon the technical phraseology of each, said that he had come to the conclusion there was nothing in any such specifications in the smallest degree forestalling, anticipating, or rendering unnecessary the plaintiff's patent, or disentitling him to the benefit of his invention. Another point had been raised against the plaintiff's specification, that it was indefinite in its terms, and bad on account of their generality and inaccuracy, but he (the Lord Chancellor) was of opinion that this objection entirely failed, and that the plaintiff had conclusively established the validity of his

patent at law. With respect to the remaining question as to the infringement of the plaintiff's patent by the defendants, the defendants had themselves declined to test the points, and therefore the Court had only to make a declaration that the plaintiff's patent had been finally established at law, and to grant a perpetual injunction in the terms of the prayer of the bill. There would also be a direction for taking the account according to the prayer, and the plaintiff's costs as between solicitor and client would have to be paid by the defendants, except the costs incurred before the Lords Justices. That part of the bill relating to the agreement of 1860 would be dismissed.—Ordered accordingly.

Copyright: Literary.—The result of the trial "Reade *v.* Conquest," has dug up a new principle, or, at least, elucidated a new theory regarding dramatic and novelistic copyright. According to the legal decision in the case in question, any novelist may secure his dramatic right by first dramatizing his story, and registering it as a play previous to his publication of it as a novel. Acting upon this determined hint, Mr Reade has given notice that his more important works are in this condition. It is quite time that so anomalous a state of matters should be ended.

Yarns: Eastwood's Application for Patent—Opposition.—This was an application by Messrs John & T. C. Eastwood, of Manchester Road, Bradford, Machine Wool Combers, for Letters Patent for an alleged invention of "A new kind of Yarn, being a combination of refuse and waste matters of fibrous materials, and the said fibrous materials and the cloth woven therefrom," their petition for which was recorded in the Office of the Commissioners on the 8th day of August, 1861. The grant was opposed by Mr J. Henry Johnson, of Lincoln's Inn Fields, on behalf of Mr Richard Rowntree Priestley, of Glasgow, Yarn Agent; and the objections were, that the alleged invention was not a new invention, and that Messrs Eastwood were not the first and true inventors thereof. It was contended, on the part of the opposer, that the "Gorilla" yarn, for which the patent was sought, was nothing more than the "Knickerbocker" worsted yarn, which was known in the market for some time prior to August, 1861; and that no new feature was involved in the "Gorilla" or the machinery for its production. It was urged, in reply, that whereas in the "Knickerbocker," the knots by which the yarn in its manufacture assumes its splashed or spotted appearance are of small bits of wool, the knots in the "Gorilla" are of silk; but the two yarns were shown to be precisely similar in all other respects. After hearing Mr Webster, of Counsel for the applicants, and Mr J. H. Johnson, on behalf of the opposer, the Solicitor-General allowed the patent to proceed, but intimated his intention to take care that it should be so limited as not to interfere with the manufacture of the "Knickerbocker" yarn.

Trade Mark: The Leather Cloth Company (Limited) *v.* The American Leather Cloth Company (Limited). Before Vice-Chancellor Sir W. P. Wood, February 7.

Sir Hugh Cairns and Mr W. P. Murray resumed a motion (part heard at the end of last term) for an injunction on behalf of the plaintiffs to restrain the defendants from selling, or exposing for sale, or procuring to be sold, any leather cloth having affixed thereon certain trade marks which the plaintiffs claimed as their own, or any other trade mark so contrived or expressed as by colourable imitation or otherwise to represent the leather cloth sold by the defendants as being the same as that manufactured by the plaintiffs, or as being that known as "Crockett's leather cloth." The plaintiffs' case was that in 1855 a company known as the "Crockett International Leather Cloth Company" was in existence in the United States, for the manufacture of "Crockett's leather cloth," in respect of which certain patents had been taken out for improvements invented by a Mr Crockett. In 1857 this business, which was then being carried on in America, and at West Ham, in Essex, was purchased (so far as related to the manufacture and sale in Europe) by the plaintiffs for £20,000, and, together with the patents and the trade marks theretofore used by the American company, was assigned to the plaintiffs' company, which was incorporated at that time. The trade mark now in contest had been used by the American company, and was continued by the plaintiffs in their trade after the purchase, and is still in use by them for "first quality" goods. It consists of the symbol usually known as the American eagle, above which is printed the word "Excelsior," and below the words "Crockett and Co's tanned leather cloth, patented January 24, 1856, J. R. and C. P. Crockett, manufacturers. 12 yards"—the whole being encircled by the words "Crockett International Leather Cloth Company, Newark, N. J., U. S. A., West Ham, Essex, England." The defendants' company was incorporated in August, 1861, and the trade mark used by them consists of an eagle, above which is the word "Superior," and below the words "Leather cloth manufactured by their manager, late with J. R. and C. P. Crockett and Co. 12 yards. Old Kent-road, London"—the whole being half encircled by the words "American Leather Cloth Company (Limited)." The plaintiffs complain of the general resemblance of defendants' trade mark to their own, but especially on the ground of the words "J. R. and C. P. Crockett and Co." being prominently put forward, the statement as to the manager having been with that firm being moreover, as the plaintiffs allege, wholly untrue, he having, in fact, being in the employ of the plaintiffs themselves. Other complaints were urged by the plaintiffs, on the ground of the defendants having also issued circulars and price current lists bearing a general resemblance to those issued by the plaintiffs, to the prejudice of their trade; and, under these circumstances, they now asked for an injunction.

Mr Rolt and Mr Fischer, for the defendants, opposed the motion, and, after denying the general resemblance of the trade marks, &c., and reading affidavits of several dealers, stating that they had never been misled in making their purchases, they contended that the plaintiffs were disentitled to relief on the ground that they were admittedly using a trade mark which was substantially untrue. The leather cloth sold by the plaintiffs was not manufactured by J. R. and C. P. Crockett, although so stated on the mark itself. The plaintiffs were not the Crockett International Leather Cloth Company, they had no manufactory in the United States, and there was no existing patent, the evidence showing that it had expired in 1859. Moreover, the plaintiffs described their manufactures as "tanned leather cloth," while it appeared by their affidavits that their trade mark was indiscriminately stamped on all their goods, whether tanned or untanned. As to the statement being untrue that the defendants' manager had been in the employ of Messrs Crockett, that was a question on the evidence, and the learned counsel contended that the statement was fully borne out. The defendants also produced several trade marks used by other manufacturers, and among them one which was stated to be now in use by Messrs Crockett themselves, who were carrying on business in America, and in which the words "J. R. and C. P. Crockett" were prominently put forward. This was sufficient to show that the plaintiffs had no exclusive right to the trade mark in question, and, at all events this Court ought not to interfere until the plaintiffs had tried their right at law.

Sir Hugh Cairns was heard in reply.

The Vice-Chancellor, after observing that this Court had ample jurisdiction to decide the contest between the parties without the necessity of directing a trial at law of the plaintiffs' right to the trade mark in question, said that the affidavits showed a sufficient *prima facie* case to entitle the plaintiffs to possible relief at the hearing, and that the better course would be to let the present motion stand over. With respect to the right of the plaintiffs to use the words "J. R. and C. P. Crockett, manufacturers," and to sell goods in that name, while the Crocketts were also selling goods in their own name in America, with a depot for their sale in England,—this raised a novel and very important question. The important part of the trade mark used by the plaintiffs was the name "Crockett," and the question was how far this Court would interfere to protect a party against the infringement of a trade mark acquired by purchase, when the purchasers had not taken care to protect themselves against the continuance of its use by the parties from whom it had been purchased. This was not the case of two partners, nor was it the case of two sons of a father, both of whom claimed an equal right* in the ordinary course of evolution; but it was the case of a person having made a contract, which might turn out to be of so imperfect a character that this Court might not be able to give effect to it. Without deciding this question upon the interlocutory application, he was very far from saying that the plaintiffs might not establish their case at the hearing. The other objections which had been urged by the defendants had not much impressed him. The plaintiffs, after buying the name "Crockett" and the goodwill of the patent, were clearly entitled to use that name. It was of everyday experience that the names of partners who had retired should be retained in the business, as in the case of banks, &c. Nor was there any necessity for the plaintiffs to change their trade mark and omit the word "patented" at the expiration of the patent; that title was given to the goods when the patent was in force, and the plaintiffs were entitled to retain it. There was, however, a further difficulty, namely, how far the plaintiffs could lawfully imprint on their goods the words "Tanned leather cloth, patented January 24th, 1856," when the goods were neither tanned nor patented. It was not clear that this would disentitle the plaintiffs, but it was one of the points which would have to be considered, in addition to the more serious one, namely, the use of the same trade mark by two persons. Then, on the other hand, looking at the course taken by the defendants, they certainly appeared to have used the name of Crockett for the purpose of obtaining an advantage to which they had not a shadow of title. They had not purchased the use of the name; and it did not appear upon the evidence that their manager had ever been with Crockett, or had ever had anything to do with that firm. Upon the whole, the better and safer course would be to order the present motion to stand over until the hearing, and the costs to abide the result.

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* His Honour here refers to a case of Dent *v.* Turpin, where he had held that one of two stepsons, who carried on distinct trades at different places of business, but had derived from the will of their stepfather (Mr Dent) the right to use the name of *Dent* as a trade mark, might proceed alone against an infringer.

TRADE MARK: THE LEATHER CLOTH COMPANY (Limited) *v.* HIRSCHFIELD. Before Vice-Chancellor Sir W. P. Wood, February 27.—The circumstances of this case, so far as the plaintiffs' right to sue is concerned, were precisely the same as in the last case. It was, therefore, agreed that the same order should be made as was then pronounced, viz., that the motion should stand over to the hearing, the costs to be costs in the cause. Sir Hugh Cairns and Mr W. P. Murray, were for the plaintiffs; Mr Rolt and Mr W. P. Murray, instructed by Mr John Henry Johnson, appeared for the defendant.

"PARAFFIN OIL:" YOUNG *v.* MACRAE—BEFORE VICE-CHANCELLOR SIR W. P. WOOD—*March* 21.—This was a motion on behalf of the plaintiffs, the owners of the patent for obtaining paraffin by the distillation of bituminous coals, to restrain the defendant, who is an oil broker, at Liverpool, from selling, under the name of "paraffin oil," or "American paraffin oil," any oil, or similar product, which had not been manufactured by the plaintiffs or their licensees, or from selling any such oil, under any other name, so as to induce the public to believe that the oil so sold had been manufactured by the plaintiffs or their licensees, and sold by them as "paraffin" oil. The case of the plaintiffs was that Mr Young, the original patentee, had in 1850 invented the process above mentioned for obtaining "paraffin," and oils containing "paraffin," and had in his specification called the oil containing paraffin by the name "paraffin oil." The plaintiffs alleged that this name was invented by the plaintiff Young, and that it was a merely arbitrary term, and was not at the time of the invention, and would not now be understood as denoting any specific chemical substance. The term "paraffin," it was admitted was not new, having been used by Reichenbach, a German chemist of eminence, in 1830, to describe a solid substance discovered by him in wood tar. The term was stated to have been derived from two Latin words, "*parum affinis*," in allusion to the remarkably small affinity exhibited by paraffin for other substances. Oil manufactured by the process described in the plaintiff Young's specification, was exhibited under the name of "paraffin oil" at the Exhibition of 1851, and the invention then attracted great notice, and a prize medal was awarded for it to the plaintiff Young. The plaintiffs have made large quantities of oil under their process, and have sold it as "paraffin oil," and they alleged that the term had for some years past been known by chemists and the public at large to denote exclusively oil manufactured according to Mr Young's invention, and that the terms "paraffin oil," and "Young's paraffin oil," were considered by the public as synonymous, and that whenever any person had of late inquired for and desired to purchase paraffin oil, he had meant the oil manufactured by the plaintiffs. It appeared that large quantities of oil similar to the plaintiffs' oil are now produced by the distillation of petroleum, which is a liquid found in the United States and Canada; and the plaintiffs alleged that the defendant had advertised for sale, and had actually sold this oil under the name "paraffin oil," or "American paraffin oil." The plaintiffs also stated that some of the oils so sold by the defendant were explosive and dangerous, and unfit to be used in lamps, and conceiving that the reputation of their oil was likely to be injured by these proceedings of the defendant, they now came to the Court for an injunction, on the ground that they had appropriated and acquired for themselves the exclusive right to the title "paraffin oil." The plaintiffs read affidavits made by Dr Angus Smith, Prof. Crace Calvert, Dr Hunt, Dr Odling, Sir Robert Kane, Dr Hofmann, Dr Sullivan, Prof. Penny, Prof. Richardson, Dr Frankland, Dr Letheby, Dr Thomson, Mr Warrington, Dr A. P. Price, Dr Stenhouse, in order to show that the term "paraffin oil" was invented by Mr Young, and was a new term when he adopted it; and, that although "paraffin" was a substance well-known to chemists, no chemical writer, except in one instance, had, even when treating of paraffin and oils containing paraffin, ever made use of the term "paraffin oil," until after the date of Mr Young's patent. The only exception to this silence on the part of writers on chemistry appeared to be contained in an article in the *Pharmaceutical Journal*, produced on behalf of the defendant, in which the writer, professing to describe a process patented by a Mr Reece, had designated the products obtained by the name, "paraffin oil." On reference to the specification of Mr Reece's patent, it appeared that the latter did not contain the term in question, and evidence was given by the plaintiffs to show that the writer of the article had written from memory, and had clearly misquoted the specification of which he professed to give an account; and the plaintiffs urged that the accidental use of the word in this manner was no answer to the plaintiffs' contention that it was substantially a new term when adopted by Mr Young.

The plaintiffs also produced evidence from brokers and others in the trade to show that the public in general believed "Young's paraffin oil" and "paraffin oil" to be convertible terms.

The defendant did not produce any witnesses connected with the oil trade, but Professor Brande, Dr Alfred Swayne Taylor, Mr Gottlieb Boccius, Dr W. A. Miller, and other witnesses made affidavits on his behalf, and their evidence was read for the purpose of showing that the term "paraffin oil" was not new at the time Mr Young adopted it; and also that it was not such a term as the plaintiffs could appropriate to themselves, inasmuch as it was a term which necessarily originated with the discovery of oil containing paraffin, or from which paraffin could be extracted; just as sperm oil or spermaceti oil has been used to designate an oil containing spermaceti.

In reply to this, the plaintiffs relied on the fact that neither Reichenbach, nor the chemists who for the 20 years next after his discovery, wrote of paraffin and oils containing paraffin, had even made use of the term "paraffin oil," but had employed other terms to designate oils similar to what the plaintiffs called by the name in question. The plaintiffs therefore argued that it was not a name which necessarily originated either with the invention of paraffin or of oils containing that substance.

The defendant further alleged he had not in fact sold oil as "paraffin oil," or "American paraffin oil," under circumstances which entitled the plaintiffs to an injunction.

Sir Hugh Cairns, Mr E. K. Karslake, and Mr W. N. Lawson (instructed by Mr John Henry Johnson), appeared for the plaintiffs. The defendant was represented by Mr Rolt, Mr Charles Hall, and Mr Rowcliffe (instructed by Messrs Gregory and Rowcliffe).

The Vice-Chancellor said that if this were the case of a plaintiff who had been using a merely ridiculous and fanciful name, like that of "Medicated Mexican Balm," in a case which had been referred to, the Court would take care that other persons should not use a name which they could only use for the purpose of interfering with the sale of the plaintiff's article. But the Court could not accept the plaintiff's view that the name "paraffin" oil was a fanciful one. The difficulty was this—here was a well known substance called "paraffin." An able chemist, the plaintiff, discovered that a useful oil could be got by the same process which produced paraffin, which oil contained paraffin, and from which paraffin could again be produced by another process. Therefore, it being an oil containing paraffin, he called it "paraffin oil." It was not a fanciful or whimsical name. Take the case of beetroot sugar, and suppose that one person manufactured that article for ten years under a patent before any one else found out another process of getting sugar from beetroot, of course during that time he would be the only person who made beetroot sugar, and in that sense it might be said that when the term "beetroot sugar" was used, it would be known that it was the sugar of the patentee. If another process was discovered, might not the person inventing and using that process call the article which he produced by using it, "beetroot sugar?" It appeared, therefore, that the question whether this was a merely fanciful name, or one suggested by the process of manufacture, was a very important one. If anybody has found a different process for producing the same article, he must call it by the same name. It did not appear that this name of "paraffin oil" was used at all in the way of a trade mark, but as describing the character of the article. Upon the conflicting evidence of commercial and scientific men as to the time when this name of "paraffin oil" first came into use, it appeared that the commercial use of it had originated with the plaintiff; but the truth was, that the name was one which it was very easy for any one speaking or writing on the subject to run into. This was shown by the evidence of a writer in the *Pharmaceutical Journal*, who had used the word. Suppose that an oil was obtained from walnuts, it must be called "walnut oil," because no other name would describe its quality. In the present case the defendant had found out a way of making nearly the same oil by a different process. There was very great doubt whether the whole world had not the right to use this name of "paraffin oil," and certainly the defendant had the right to use it, prefixing, as he had done, the word "American." As the defendant had done this, the Court would not assume that he had acted with any bad faith, and the motion must consequently be refused.

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REVIEWS OF NEW BOOKS.

THE JEWELLERS', GOLDSMITHS', AND WATCHMAKERS' MONTHLY MAGAZINE. 4to, pp. 16. Illuminated lithographs and Wood Engravings. London: William Dorwer, 1862.

"THE Jewellers', Goldsmiths', and Watchmakers' Monthly Magazine," is a new serial candidate for public favour; working upon ground hitherto untrodden, in a literary sense. In addition to two quarto coloured plates and some wood engravings, No. I. contains original articles on "Goldsmith's Work of the Medieval and Renaissance Periods," "Horology in Switzerland," "Charms, Talismans, and Amulets," "Art in Relation to Goldwork and Jewellery," "Trade Marks," and "The Jewellers', Goldsmiths', and Watchmakers' Encyclopædia." The designs of the bracelets, brooches, and watches, are very good, and their continued introduction will no doubt tend to make purity in ornamentation much better understood by the general public; and, hence, in the end, conduce to bring about the exercise of superior care on the part of the makers, who will necessarily have to work up to the improved taste. We shall be glad to see the excellence of the present number kept up in those which are to come.

METALLURGY: THE ART OF EXTRACTING METALS FROM THEIR ORES, AND ADAPTING THEM TO VARIOUS PURPOSES OF MANUFACTURE. By John Percy, M.D., F.R.S. London: Jno. Murray, 1861.

THE appearance of this long-looked-for book was probably *the event* in the world of British scientific publication of the past year. It is but a single volume in bulky octavo, plethoric of information in its close and clear set type and numerous beautifully executed wood-engraved illustrations. Though for the present standing alone, it is to be followed by another volume (the materials of which are nearly all collected), and which, the author announces, will complete the work, and will appear this year. It seems somewhat paradoxical, in reviewing a work as to which we have much to praise, to say that we wish it had never been written; we do, however, confess that we think it greatly to have been desired that Dr Percy had taken a wider basis, and stepping somewhat off the pedestal of his own professorial chair of metallurgy, having given us a great and systematic work, upon chemistry applied to arts and manufactures, involving in that, of course, the whole subject of metals and their various treatment.

Resident and practising as a physician (and, we believe, consulting chemist), for some years at Birmingham, Dr Percy's name was brought prominently before European science some twenty years ago or more, by the analytical accuracy and experimental power evinced in his researches upon the slags of furnaces, more especially those of iron metallurgy. These at once assured his scientific reputation, which has been steadily growing year by year since, and with increasing rapidity since his appointment to the chair of metallurgy at the School of Mines, London.

His present work gives ample evidence of how steadily he has been, for the two last decades, hiving practical knowledge, and how vast the repository of applied science his mind has become, with the rare opportunities and advantages afforded him by his early education and habits of thought, by his earlier residence in the very heart of the most varied metallurgies, and other processes, which Stratfordshire so richly presents, and by the personal access to manufactories, and men of all sorts and conditions, which his position since in London, has afforded

With such qualifications, it were to be wished that our author had thrown aside the old and rather hazy limitation of metallurgy, and given us a work that should have embraced the great and varied other information, he is so competent to convey on all our great chemical manufactures—on salt and soda making; glass and pottery; glass staining and enamels; colours; and many others. Upon, for example, the colour Ultramarine, of the artificial production of which chemistry is so justly proud, and the importance of which is becoming daily greater, we happen to know that Dr Percy is in possession of the most valuable experimental information.

We possess, in reality, in English, no complete work on chemical manufactures, although some works still incomplete, and much of the character of monographs, and some scattered encyclopedic information exists. Why should we not have from Dr Percy a work that should, for England, co-ordinate with "Dumas Chemie Appliqué aux Arts," (which remains, we believe, untranslated), and with the stamp upon it of our own great chemical industries, and filled, like the volume before us, with specialities of knowledge as yet nowhere accessible. Let us hope for this hereafter.

Dr Percy limits his definition of metallurgy to "The art of extracting metals from their ores, and adapting them to various purposes of manufacture." Accepting such a limitation, we should rather in the sense in which the book is intended, say, that it is the *science* of this art—the *principles* upon which the *art* depends—and this *is* the author's meaning as he explains further on in his introduction.

The "μεταλλουργεια" of the Greeks, however, had a much wider subsense, as the root of "μεταλλον"—anything concerning change of state, (metallic or otherwise) indicates. It inferred much more than the German "Erzkunde," which is not correlative.

Johnson defines our word metallurgy, "working in metals, or extracting them from their ores." At one end, we may accept the limit set by Dr Percy, thus in practical accord with the great grammarian, but how are we to fix the other? Dr Percy has himself even overstepped his own limit, notably in the valuable chapter in which he makes a *precis* of our knowledge of the greater or less corrosion by sea-water, &c., of copper sheathing. If rolling of copper sheathing be within the limit of "adapting metals to purposes of manufacture," and not a metallic manufacture itself, we do not see where metallurgy is to stop short of Johnson's "working in metals," it must go on even to hammering out pots and kettles.

Mercury, to be fitted for one purpose of manufacture, must be made into fulminate; but if this is to be fully described, it must involve almost, if not altogether, the manufacturing principles and processes of percussion-cap making. If Violet's processes for making charcoal are to be considered, in the aspect of fuels, how undesirable to halt short of its use and that of other charcoals for gunpowder? If slags, and the varied conditions of fusible or infusible clay compounds, are properly to be treated, with the system and copiousness that distinguish Dr Percy's chapter on slags (p. 20), and that, again, on fire-clay (p. 208), how baulking and undesirable it seems, to stop short on the very threshold of all that leads to brick making at large, (for the author does treat of fire bricks) of pottery, porcelain, and glass. In a word, as the author himself says, that "chemistry, physics, and mechanics must be the foundation of the science of metallurgy," so it seems to us that metallurgy ought to merge in applied inorganic chemistry, and the self-imposed restraints of an imaginary boundary be removed, that has no result now a-days, but to obscure the great relations, scientific and practical, that the metallic chemical, manufactures and arts, bear to those that are unmetallic.

To say that Dr Percy's present volume is the best on metallurgy in the English language, is perhaps not to say very much, for all the English books on the subject, other than a few mere translations, may be reckoned off on one's fingers; and all are out of date for every one but the metallurgic historian or archæologist. "Pettus on Metals," "Price's Mineralogia Cornubiensis," "Cramers's Assaying," and "Dr Lewis's Commercium Philosophico Technicum," almost exhaust the list. The last named delightful old book will still repay a perusal. Dr Lewis was, perhaps, the very earliest English author who wrote largely upon "Platina," and passages may be pointed to, in this work, that in all probability, gave to Dr Wollaston the first hints to his final success, in eliminating the other metals from crude platina, and working the purified metal into a laminated form.

We can, however, say much more than this of Dr Percy's book. It is unquestionably one of the most valuable works on metallurgy that has *ever* appeared, and possesses this distinguishing characteristic from all others, that besides the purely scientific view of the reactions treated of, which form the great staple of most foreign systematic works, it abounds in details of metallurgic working, of the most practical and actual character, and brought up to the existing moment. By far the greater number of the patented processes that have modified our metallic industries, are described and discussed, and the defects of novelty, or in other respects, are often noticed. In the course of his extensive reading, the many useless, absurd, conflicting, or repetitive patents that encumber the rolls in his own department, must, no doubt, have struck Dr Percy, as they will in any department, strike any man, who shall pursue the multifariousness of human invention and thought, along any one road of progress. That Dr Percy should have stepped out of his way and legitimate subject, however, to devote a distinct chapter to "Remarks on the Patent Laws," and to endorsing, even in appearance, the crudities of Sir Wm. Armstrong on the subject of their abolition, we much regret, the rather, as the remarks which the author does make, prove how imperfectly as yet he has considered the subject, how incomplete and indistinct, as yet, are his notions as to what *are* the real defects in our Patent Laws, and in their administration, which, undoubtedly, have long demanded attention and reform.

With Mr Grove, he thinks the legitimate object of Patent Laws is to reward not *trivial* inventions, which stop the way to greater improvements, "but is not prepared to admit that protection should cease to be afforded to really meritorious inventors." Now, let us ask—Who is to decide beforehand what *is a trivial* invention, or who is the *meritorious* inventor? Can anything but the ultimate running out and issue of the patent decide either? Is it *possible* to reward by law, or in any other way, a really *trivial* invention? If it be trivial and useless, it drops through, society has given its verdict, and no one but the inventor has been injured, by his having spent his money in vain, for protecting that which was not worth protection.

We will take an example, one that Dr Percy will himself appreciate, to show what chance there would be of "righteous judgment," if some commissioner or judge, were empowered to decide at once upon what was to be

held as trivial, what not. Probably no invention or discovery can be pointed out in the whole range of metallurgy that has had more important results, or that has poured into the lap of the inventor greater gain than Neilson's invention of the Hot-Blast. Now it is well known that, when first patented, the use of heated air as blast, was held by all scientific men contrary to sound principle, and that the inventor himself had so little idea of what was to come out of it, and had been told so often, and by such big wigs, that his invention was *trivial* and useless, that (and this is within the writer's own personal knowledge), sometime after the patent was taken, Mr Neilson offered, and in vain, to sell a very large portion of his entire rights for a few hundred pounds. It was not until after the Bairds of Gartsherrie had *tried* the hot-blast, and that this "proof of the pudding" at once showed an enormous increase in the yield of the blast furnaces, and then that raw coal might be substituted for coke, that the scientific big wigs, and the practical men too, became suddenly convinced that this was no trivial invention; and that the inventor "woke and found himself famous" and a millionaire. Was he a "meritorious inventor?" Probably he had at the commencement very little clear notion of the issues; but had his trivial invention not been patented at all, it is highly probable that iron would be making everywhere with cold blast to-day.

Upon such distinctions, no reform or improvement of Patent Law of a workable character, can be based. This, however, as one reform amongst many others, can be done. The law as it stands should be rigidly exacting, as to that most fraudulent class of so-called inventions, which show themselves only as a net, to catch other people's results, for the next fourteen years—in the form a specification usually of enormous length and prolixity, in which nothing is precise, nothing really new, all vagueness, and pompous pretence and charlatanerie. Metallurgy is indeed full of such patents as these; alloys embracing all the metals known in various permutations and for all sorts of purposes, or for none in particular—steels —with wonderful alloys (which analysis cannot discover), and with amazing scientific names, and so forth—these are *frauds* attempted *in presentet in prospectu*. The law as it stands, if fairly administered, could check all that by simply requiring the conditions of a specification to be justly fulfilled in all cases. Familiarity with instances of this sort has justly excited Dr Percy's indignation. Here we are quite in accord with him. It seems scarcely logical, however, to hint at tearing down the house, as the best remedy, for the neglect and malpractices of the servants, who have let thieves break in and steal.

To return, however, to the pleasanter consideration of the main and proper contents of the work. Dr Percy, in his introduction, condenses into 12 pages all that he says upon "certain physical properties of the metals." He guards himself then against the supposition that he meant to do more. What he has given is well done; but admitting, as he does, that physics is one of the three stand points of metallurgy, we could have wished this introduction more exhaustive; especially do we think it should have treated as fully as the state of knowledge admits, of all that relates to the state of aggregation, of metals, and of the changes in their crystalline arrangement (real and imaginary), which occur under various conditions, temperatures, &c. This is a matter that interpenetrates every part and question of metallurgy.

The first part of Dr Percy's work—general considerations of metallurgic processes, &c.—embraces the subject of slags, with many of his own original researches. At the latter end, some highly curious and interesting matter is to be found, in discussing Plattner and Merbach's methods by means of Pyrometric alloys of gold and platinum, for determining the fusing temperatures of slags, &c. The next part is devoted to fuel, and is gone into very thoroughly and completely, with the exception perhaps of the section on peat. No notice is taken of the simple and excellent kilns for the artificial drying of turf, long in use in North Holland, and described in the Transactions of the Institution of Civil Engineers of Ireland some years ago. Nor are the facts as to Vignolles's Patent, for the carbonization of peat by superheated steam, either fully or correctly given. They happen to be within our own personal knowledge. Vignolles's process was never attempted to be tried in Ireland, no more than the Dutch desiccating kilns recommended by Mallet. Famine and potato rot at that time stopped all that. Vignolles's estimate of cost, however, was true for Ireland at the time it was made; and when Sir R. Kane stated to Dr Percy in 1861, that the present cost in Ireland, of the peat necessary to produce one ton of peat charcoal, would exceed by 3s 8d, the sum stated in Mr Vignolles's estimate as the total cost of a ton of the charcoal, he should also have stated that wages in Ireland have, since then, more than doubled in value, and that peat there, is still collected, stacked, and dried (when it *can* be dried at all) by the old labour wasting methods. It might be added that Sir R. Kane is himself partly to blame for this absence of all improvement in the preparation of peat in Ireland, by having in a manner, far from personally creditable, attempted to damage the adoption of the Dutch kilns, by enabling Dr Rees Reece to make some statements with respect to them, which were absolutely and transparently untrue, in his (Sir R. Kane's) report "On the Nature and Products of the Destructive Distillation of Peat, &c.," made as Director of the Museum of Irish Industry in 1851.

Dr Rees Reece, it will be remembered, was the chemical projector, whose Paraffin Candle was exhibited in the House of Commons, when that body was informed that Irish peat could by his patent, be made worth £100 per ton! Dr Reece succeeded in burying in Irish bog, a great deal of other people's money, and burning various fingers in his combustion process. Sir R. Kane's *ex cathedra* report upon this "enormous sell," so far as it meant anything, was favourable; and the actual results have since proved how trustworthy as financial and economic data, were his scientific conclusions.

Yet, even to-day, the introduction to Ireland of these Dutch kilns, to make peat preparing, independent of weather, still more, if with the improvements, that Siemens' Patent Furnaces, described in our last part, would admit of being added to them, would mark an epoch, in the future supply of fuel in that part of the empire, and reduce its cost most materially, as well as greatly improve its average quality.

Vignolles's process for carbonization has, as we have said, never been tried in Ireland; but extensive works were erected at Friessac, in Prussia, where large quantities of the peat coke were made, and sent by the Hamburg and Berlin Railway, into the latter city. It was used largely there, for domestic culinary fuel, and also tried for some time upon the railway, for locomotive use. The coke produced was as excellent in quality as could be produced from the very inferior thin peat of Friessac, and when made, there, from some best Irish turf, imported for the experiment, proved still better. Mechanically and financially the process was a complete success.

The real cause of failure was this: The peat coke had the property, (and all peat coke has the same more or less) when heated in becoming ignited, of cracking and falling to pieces; it was also so tender and easily broken, that a few miles carriage, on the railway or road, reduced a great proportion of it to gross powder. Owing to these causes, the waste was excessive in use, and the fires damped, in consequence of the draft being checked by the small bits of coke, or the latter, with the sharp blast of the locomotive, were driven in masses through the tubes and into the smoke box.

Dr Percy has some excellent remarks upon Berthier's method of determining the calorific power of fuels. We must say, however, we do not agree in the statement, that "it is an erroneous belief that the amount of heat evolved by combustion is proportionate to the oxygen consumed." The direct results of experiment, no doubt, have not appeared to prove it so; but, as we believe, simply because hitherto they have not been fully and truly discussed.

When combustion of a solid fuel takes place, great changes *of volume*, both of the combustible, and of the supporter, take place; and when the latter is common air, large volumes of nitrogen, not only are carried off heated, but with changed volume also. The heat equivalent to these respective changes of volume has not been considered, or allowed for (so far as we are aware); but if they be so, we believe it will be found that the heat of combustion, is precisely proportionate to the amount of the supporter (oxygen) consumed.

On the analogous subject of the experimental determinations of the relative values of steam coal for naval or other uses, Dr Percy makes some very pertinent strictures, although not going as fully into that matter as he might have done in larger space.

We have, then, a capital chapter on the materials of furnaces, crucibles, retorts, etc.; and the most exhaustive and complete statement of our knowledge of fire-clays, British and Foreign, to be found anywhere, with incidental descriptions of Sefstrom's and Devilles' blast furnaces, and a great deal of other connected information.

And now come the three *pieces de resistances* of the work—the great chapters on the metallurgy of copper, of zinc, and of brass. Each is preceded by an historical introduction, in which the author proves how lovingly, and how thoroughly, and with what scholarship, he approaches his subject. In these histories, the professed archæologist even, who takes little interest in metallurgy as a science, will find pleasant reading, and probably information new to him.

In the chapter on copper, we have the chemistry, and the metallurgy proper, i.e., the heat reaction of copper, then the history of copper smelting in Britain, the mineralogical and chemical description of the ores; and then, in all detail, verified by the revision of the smelters themselves (as Dr Percy informs us), the Welsh copper smelting, followed by the science of these varied and singular processes, or the reactions that occur in the Welsh smelting process, with analyses of the products, stage by stage, from the crude ore to the finished metal.

Then follows, the elimination of certain foreign metals during the Welsh process—miscellaneous notices of various improvements in copper smelting—copper smelting in blast furnaces—kernel roasting by Agordo —wet methods of extracting copper—and a concluding part on the methods of assaying. We regret that our space forbids doing more than giving this bare catalogue, of the main heads only, of this *one chapter* on copper. It would be difficult to over rate the copiousness and value of the information so completely given; but to form even a competent notion, of the mass of intellectual material here collected and lucidly arranged, the book itself must be examined and read.

We should have to say much the same of the succeeding chapters on zinc, and on brass. Want of space must, however, not prevent our noticing that a great deal of the chapter on zinc is (to us at least) absolutely new, and so far as our reading goes, is not to be found published elsewhere. In this part in particular, the wood-cuts of furnaces, apparatus, etc., everywhere good, are pre-eminently clear and excellent. The zinc sublimation and reduction furnaces, at pp. 553, 564, may be pointed to as examples of this; the scale, though small, is so well kept, that they might be used easily as actual working plans, by the furnace builder. In this chapter, too, we have a complete code of instructions for the assaying of the ores of zinc—a class of assays hitherto but very ill understood in these countries.

We wish we could continue so as to notice much of the important and some of the highly curious information on the alloys of copper and zinc, and brass in various relations, but we are warned to have done.

We have praised this book highly; we have done so honestly and as its due. We have, however, not praised it indiscriminately; to do so of any book argues either want of good faith, or want of that preliminary knowledge of the subject, that should make either praise or censure alike valueless.

We could have desired a more systematic book, and we know the author is competent to have given us such; but the book he has given us we highly prize, and are satisfied that a constantly enlarging circle of the numerous classes in our own country, as well as abroad, who are interested in metallurgy, will do so too.

It will add much to Dr Percy's scientific reputation, and long remain a standard book of reference to manufacturers and to men of science.—Ed.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

A NEW FURNACE FOR BOILERS, &c.

Sir,—I desire to record a remarkable circumstance attending the supplying furnaces with heated air, which has been hitherto unnoticed, or at least not made known; it differs from the hot blast for smelting purposes. The heated air is obtained by keeping the ash-pit entirely closed, except when open for removing ashes, and an arrangement for passing one or more streams of air from the back of a boiler bed through separate flues, built in the solid brickwork beneath the whole length of the lowest fire flues, from thence into the ash-pit through the bars into the furnace. The result derived from this mode when applied to heating gas retort's; according to a model exhibited at the "Society of Arts" last year, may surprise your readers, who might suppose that it would occasion increased trouble with clinkers. The great object now being to check their forming by evaporating pans in the ash-pit, which usage causes clinkers to become very hard—their removal often breaking the brickwork. Whereas, by thus totally reversing the present plan, and drawing out the heat absorbed by the brickwork, and recovering the heat radiated from the floor of the furnace, and repassing it through the bars, clinkers are formed of so soft a nature as to be clearable with a rake. In fact, with one exception, firemen attending on these furnaces have told me that they would sooner have charge of two altered furnaces to one of the common kind. I believe when this mode becomes known and tried it will be generally appreciated.—Yours respectfully,

George Walcott, C.E.

24 *Abchurch Lane, London, E.C.,*
March 17, 1862.

[That there are advantages in the arrangement referred to by our correspondent, is manifest to any who have read our account of Mr Siemens' Patent Furnaces in our last part. What is above described seems to approach very near, in principle to what Siemens' patent protects.—Ed.]

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

Nov. 21, 1861.—"On some Varieties of Tannin"—"On Larixinic Acid, a Crystallizable Principle in the Bark of *Pinus Larix*," by J. Stenhouse.—"On the Great Magnetic Disturbance of August to September, 1859, recorded at the Kew Observatory," by Balfour Stewart, M.A.—"On the Aquiferous and Oviductal System in the Lamelli-branchiate Mollusks," by G. Rolleston, M.D., and C. Robertson.—"Researches on the Polyammonias, XVI. Triatomic Ammonias, XVII. Mixed Triammonias, XVIII. Tetrammonium Compounds," by Dr Hofmann.—"On the Lead-Zinc and Bismuth-Zinc Alloys"—"On some Gold-Tin Alloys," by A. Matthiessen and M. Von Bose.—"On the Sensory, Motory, and Vaso-Motory Symptoms from Refrigeration of the Ulna Nerve," by Dr A. Waller.—"Note on the Oxidization and Disoxidization effected by the Peroxide of Hydrogen," by Prof. B. C. Brodie.—"On the Contact of Curves"—"On the Calculus of Functions," by W. Spottiswoode.—"On the Action of Hydriodic Acid upon Mannite," by J. A. Wanklyn and Dr Erlenmeyer.—"The Lignites and Clays of Bovey-Tracey, Devonshire," by W. Pengelly.—"The Fossil Flora of Bovey-Tracey," by Dr Oswald Heer.

Nov. 30, 1861.—The Fellows of the Royal Society assembled in considerable numbers at their anniversary meeting on this, St Andrew's Day—a meeting more than usually interesting, as Sir Ben. Brodie, the President, then delivered his farewell address on resigning the chair. The attention with which the eminent surgeon's words were listened to marked the feeling of respect and admiration for his character that prevails among the society over whom he has so well presided. After the delivery of the medals, the meeting proceeded to ballot for council and officers for the ensuing year, and the following were declared duly elected:—President, Major-General Edward Sabine, R.A., D.C.L., LL.D.; Treasurer, William Allen Miller, M.D., LL.D.; Secretaries, William Sharpey, M.D., LL.D., Mr George Gabriel Stokes, M.A., D.C.L.; Foreign Secretary, Mr William Hallows Miller, M.A.; other members of the Council, Mr John Couch Adams, M.A., D.C.L., Sir William George Armstrong, C.B., Benjamin Guy Babington, M.D., Sir Benjamin Collins Brodie, D.C.L., Mr George Bowdler Buckton, William Benjamin Carpenter, M.D., Sir Philip de Malpas. G. Egerton, William Fairbairn, LL.D., Captain Douglas Galton, R.E., Mr Wm. Robert Grove, M.A., Q.C., Mr William Hopkins, M.A., LL.D., Mr John Lubbock, Mr James Paget, Mr J. Prestwich, Mr W. Spottiswoode, M.A., and Mr J. Tyndall.

Dec. 5, 1861.—"On Crystallisation and Liquefaction," by Mr J. Thompson.—"Determination of the Magnetic Declination, Dip and Force at the Fiji Islands in 1860 and 1861," by Col. W. J. Smythe.—"On the Calculus of Functions," by Mr W. H. L. Russell.—"On Tseirnhausen's Transformation," by Mr A. Cayley.

Jan. 16, 1862.—"On the Development of Striped Muscle in Man, Mammalia, and Birds," by J. L. Clarke, Esq.—"On the Influence of Temperature on the Electric Conducting Power of the Metals," by A. Matthiessen, Esq.—"Notes of Researches on the Poly-Ammonias XVIII. Aromatic Diamines," by Dr Hofmann.

Jan. 23, 1862.—"Action of Chloracetic Ether on Triethylamine and Triethylphosphine," by Dr Hofmann; "On the Influence of Physical Agents in the Development of the Tadpole and the Frog," by J. Higginbottom; "Internal Radiation: On the Intensity of the Light Reflected from or Transmitted through a Pile of Plates," by Prof. Stokes.

Jan. 30, 1862.—"On the Calculus of Symbols," by Mr W. H. L. Russell.—"On Internal and External Division in the Calculus of Symbols," by Mr W. Spottiswoode.—"On Absorption and Radiation of Heat by Gaseous Matters," by Prof. Tyndall.

Feb. 6, 1862.—"On the most Correct Methods of Inquiry in Reference to Pulsation, Respiration, Urinary Products, Weight of Food, &c." by Dr E. Smith.—"On the Motions of Camphor on the Surface of Water," by C. Tomlinson.

Feb. 13, 1862.—"On Magnetic Calms and Earth Currents," by Mr C. V. Walker.

SOCIETY OF ARTS.

Nov. 20, 1861.—Sir V. Phillips' inaugural address.

Nov 27, 1861..—"On the Foreign Department of the Exhibition of 1862," by Mr P. L. Simmonds.

Dec. 14, 1861.—"On the Building for the Exhibition of 1862," by Capt W. C. Phillpotts.

INSTITUTION OF CIVIL ENGINEERS.

Nov. 21, 1861.—"On the Hooghly and Mutla," by Mr Longridge.

Nov. 26, 1861.—"On Measuring Distances by the Telescope," by Mr W. B. Bray.

Dec. 3, 1861.—"On the Discharge from Under Drainage, and its Effect on the Arterial Channels and Outfalls of the Country," by Mr J. Balley Denton.

ROYAL INSTITUTION.

Jan. 17, 1862.—"On the Transmission of Heat through Gases and Vapours," by Professor Tyndall.

Jan. 24, 1862.—"On the Affinities and Differences between the Brain of Man and the Brains of certain Animals," by Professor Rolleston.

Jan. 31, 1862.—"On the Theories of the Motions of Glaciers," by Mr Hopkins.

CHEMICAL SOCIETY.

Nov. 21, 1861.—"On Leucic Acid, and some of its Salts," by Dr Thudichum. The acid was made by treating leucine with nitrous acid gas and exhausting the product with ether. Its formula was determined to be $C_{12}\ H_{12}\ O_8$.—"On the Occurrence of Crystalline Deposits of Phosphhate of Lime in Human Urine," by Dr Bence Jones. The formation of these crystals was shown to depend upon the amount of lime in the urine and upon the degree of its acidity. They could be produced at will by the administration of acetate of lime.—"On Sparteine," by Mr E. J. Mills. The volatile oily base obtained by Stenhouse

from *Spartium scoparium:* 150 lb. of the plant yielded 22 cubic centimètres of sparteine. It was shown to be a diammonic base, having the formula $C_{30}\ H_{26}\ N$.

Jan. 16, 1862.—"On the Simultaneous Variations in the Amounts of Hippuric and Uric Acids Excreted," by Dr Bence Jones; "On the Solubility of Sulpbate of Lead in Hydrochloric and Nitric Acids," by Mr G. F. Rodwell; and "On a New Method for effecting the Substitution of Chlorine for Hydrogen in Organic Compounds," by Dr H. Müller.

Feb. 6, 1862.—"On Ground Ice," by Mr R. Adie.—"On the Occurrence of Crystalline Xanthin in Human Urine," by Dr Bence Jones.—"On Silica," by Mr A. H. Church.—"On the Source of the Arsenic contained in Commercial Sulphuric Acid, and on the Preparation of the Pure Acid," by Prof. Bloxam.—"On Deposits of Phosphate of Lime in Teakwood." by Prof. Abel.—"On the Oomposition of the Water of a Boiling Spring in New Zealand," by Prof. J. Smith.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

Nov. 28, 1861.—"On Geology, in its Relation to Mining, Engineering, and Agriculture," by Mr R. C. Paterson.

Feb. 13, 1862.—"On the Methods of Illuminating Light-Houses," by Mr G. B. Jerram.

INSTITUTION OF MECHANICAL ENGINEERS.

Jan. 30, 1862.—"On a Regenerative Gas Furnace, as applied to Glass Houses, and Puddling and Heating Furnaces," by Mr C. W. Siemens.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Jan. 7, 1862.—"Experiments on some Amalgams," by Mr J. P. Joule.—"On the Conductibility of some Heat by Amalgams," by Dr F. C. Calvert and Mr R. Johnson.

GEOLOGISTS' ASSOCIATION.

The first ordinary meeting for the present Session was held at 5 Cavendish Square, on the 4th ultimo, the Rev. Thomas Wiltshin, M.A., F.G.S., President, in the Chair. Thirteen new members were elected, and there was a very large attendance of members and visitors. Professor Morris, F.G.S., delivered a most interesting lecture on "Coal, its Geological and Geographical position." After the lecture, the President announced that the Committee had determined upon conducting, in the course of next session, a series of excursions to Tunbridge Wells, Harwich, Cambridge, and Lewes. The localities visited by the Association during the last session were Reigate, Oxford, and the Isle of Sheppy, when the members had an opportunity of seeing the Lower Green sand, the Coralline Oolite, and the London clay formations. A full account of these excursions is given in the proceedings of the Association.

SCOTTISH SHIP-BUILDERS' ASSOCIATION.

Jan. 6, 1862.—"On Sub-Marine Operations," by Mr A. Brown.

Feb. 3, 1862.—"On Armour Plating for Ships of War," by Mr L. Hill.

The author commented on the usual plans of jointing the armour with bevelled edges, triangular and square grooves, and feathers, half-checks, and ridges; and also upon the cost of the very broad heavy plates—15 feet long by 3½ feet broad, weighing between 4 and 5 tons, and costing as much as L.50 per ton—used in covering the sides of our present armour-clad ships. The objection to narrow armour plates was usually understood to be that the joints were the weakest parts, of which the fewer the better; but if some method could be found of making and fastening armour plates of 1½ to 2 tons weight, costing not above L.15 to L.20 per ton, so as to be as strong at the seams as at the centre, one great difficulty and enormous expense would be overcome. It would be a great matter to save L.30,000 on the armour of a vessel like the Warrior. And he concluded by proposing a mode of making and securing armour plates of the sizes recommended, by which the seams were actually made the strongest parts of the armour, and all bolt-holes—another source of weakness in the present modes of armour plating—were avoided.

Mr Hill next exhibited and described the drawings of a new governor for marine engines. He explained the method of fitting it up and its mode of action. The one he described was, he believed, the only one of the kind, and had been fitted into a screw steam yacht of about 300 tons, built by his firm about two years ago; and he was informed by the owner that it was an excellent governor, remarkably sensitive, and not liable to derangement.

SOCIETY OF ENGINEERS.

Jan. 13, 1862.—"On the Enclosure of Lands from the Sea, and the Construction of Sea and other Banks," by E. Olander.

Feb. 3, 1862.—"On the Action of Peaty Matter containing Copper on a Boiler," by Mr E. Riley.

GEOLOGICAL SOCIETY OF IRELAND.

The Society met at the Museum Buildings, Trinity College, on Wednesday evening, the 8th January, 1862.

The Rev. Professor Haughton, President, in the Chair.

Mr R. H. Scott (Hon Sec.) read the following from the Rev. R. V. Dixon, "On the Occurrence of an Ancient Pavel Road under deep bog, in the neighbourhood of Omagh, County Tyrone."

Mr Scott read the following letter from C. W. Palliser, Esq., addressed to W. MacDougall, Esq., on a submarine bog recently discovered in Wexford Harbour:—

"My dear Sir—I think you may be interested in the following facts. In sinking last June for foundations for the new engine-house, on the north side, at a place upwards of 900 yards from the nearest land, that is from the former high water mark, after going through fourteen feet of blue mud we came upon turf containing bog oak and deal in considerable quantity. After passing through about six feet of this we found mud again, of a greyish colour, two feet in depth, and then we came on solid marl, on which we built."

Mr Scott read a letter from John Locke, Esq., on flint implements in drift, which he was disposed to attribute to the ordinary tendency of coarse gravel to sink in clay.

Mr W. H. Bailey, F.G.S., read his paper "On Grapolites and a Theca from Lower Silurian Rocks, in the Counties of Meath, Tipperary, and Clare."

The President read the following letter from the Rev. John Storrs, relative to the gold fields of Nova Scotia:—

"The Rectory, Cornwallis, Nova Scotia,
B. N. America, Nov. 27, 1861.

Dear Sir,—The gold fields of Nova Scotia appear in some degree to attract the attention of the home press. Several times I have thought of addressing you—not to describe them, for scientifically I should fail; and I have been led to believe that your knowledge of the geology of these parts has brought you in some measure acquainted with their nature and extent. Dawson, now president of M'Gill College, Canada, is the best Nova Scotian colonial authority as a geologist. Gesner, a native of this parish, though now residing in the United States, is not considered equal to President Dawson. So far as relates to the gold fields of Nova Scotia, I would merely state a few facts relative to the light in which these auriferous regions are regarded by our natives and settlers. All individuals who have tried their luck—*i.e.*, alone, or by twos or threes—have generally been glad to return to their ordinary labour, whether on the farm or in the woods, satisfied that remuneration was quite a lottery at the gold mines, with more blanks than prizes. In several instances companies have been formed by persons of means to take shares, so as to employ miners at stated wages. These companies have not all been successful, though I believe some of them have done more than pay wages; and one or two of the real business-men sold out their rights when the excitement was great, and in that way realised a profit. The population of this county—called King's County—exceeds eighteen thousand. During the past summer and autumn nearly all the men and youths visited one or other of the mines, intending to prosecute work as a real business, and nearly all returned after a few weeks' or months' absence, quite contented to resume the plough, the axe, or other implement of toil, and wages have not for eight years been so low nor men so abundant. And yet I think there is gold in sufficient abundance to reward the miners. No doubt the best method to be pursued is for responsible parties to form companies, and to hire labourers at stated wages. The Provincial Government thus invite the enterprising to come forward, and, no doubt, they think that enterprise would be rewarded. Our winters might present obstacles which milder climates do not, and our autumnal rains are always very heavy, filling every pond or pool, and swelling every brook or stream into an angry current. The minerals of the province belong to the Crown, and not to the owners of the soil. Next year, no doubt, will test their value."

The meeting then adjourned."

GEOLOGICAL SOCIETY OF DUBLIN.

Anniversary, 14th Feb., 1862.

President's Address.

We have, by the favour of Professor Haughton, F.R.S., the president of this energetically-working society, of which the president, Mr. B. Jukes, F.R.S., and a few others, are the most moving elements, received in slips, his presidential address, before it has appeared elsewhere in type. The great scientific value of the President's views, as to the geology of the igneous rocks, induces us to lay entire before our readers, all that important portion of his address that refers to the subject: as follows:—

In former addresses to this Society, I have invited your attention to various astronomical theories of the original formation of our planet, of the internal heat of the globe at present, and of the causes of change of climate; and in my last annual address I endeavoured to present to you my views of the physical causes of the elevation of our great mountain chains, and of the depression of our deep sea valleys.

On the present occasion I purpose to follow up my former addresses, by giving you my views as to mineralogical and chemical composition of the rock masses of which the earth is composed; and in so doing I shall carefully distinguish my own speculations from the numerous and well-ascertained facts observed by myself and others, more especially the chemical geologists of Germany and France, in which countries, the physical and chemical laws at work among our rocks, and the physical history of our globe itself, receive that attention which their importance demands, and which they in vain solicit from the eyes and pens of English geologists.

I adopt as the fundamental hypothesis of the physical history of our globe the nebular theory of Laplace, and the physico-chemical hypothesis of Durocher, which supposes the two outer layers of our globe (on cooling from the molten conditions required by the hypothesis of Laplace), to have acquired their relative positions of outer and inner layer, not only by virtue of their relative specific gravities, but also in accordance with their definite chemical compositions; so that the specific gravity of each layer, which, by the action of

mechanical laws, fixes its position in the earth, is itself the result of its chemical and mineralogical composition.

The hypothesis of Laplace is so well known, that I do not feel it necessary to describe it; but that of Durocher is so little known or understood, that I gladly avail myself of the present opportunity to offer it to you in his own words—

"An immense number of consequences may be logically derived from the following proposition, the proof of which I shall furnish presently, viz:—*That all igneous rocks, modern and ancient, were produced by two Magmas, which coexist below the solid crust of the globe, and occupy there each a definite position.*

"The Upper Magma, which is rich in silica, and poor in earthy bases and oxides of iron, possesses the least specific gravity; and in this respect there are differences among the rocks produced by the two Magmas, from one and a half to twice as great as between oil and water. The separation is still greater if, in place of considering the rocks in their natural condition, we compare the vitrified products obtained by their fusion: further still, if we refer them to their liquid condition, there ought to be, according to Bischoff's experiments, between the rocks arising from the two Magmas, differences twice greater than those observed in their crystalline state, and, therefore, from three to four times greater than those between oil and water; from these facts may be deduced the necessary and permanent separation of the two Magmas.

"These two Magmas have undergone but slight changes of composition from the most remote geological epochs; and, moreover, they differ essentially from each other by means of well-defined characters. The one may, from its excess of silica, be called the Acid Magma; while the other is comparable to a basic salt; for its silica is not in sufficient quantity to saturate its metallic oxides. The difference of silica in the two Magmas is in the proportion of 7 : 5. They contain nearly the same quantity of Alumina; but the Siliceous Magma contains from one a half to twice as much alkalies, and more Potash than Soda, while the reverse occurs in the Basic Magma. The first is specially characterized by its poverty in earthy bases, and the iron oxides; of these, it contains from six to eight times less than the other.

"The following Table gives the composition of these Magmas, and the specific gravities of the rocks derived from them.

	Proportion of Elements.			
	Mean Proportions in the two Magmas.		General limits of Proportions in the Igneous Rocks.	
	1. Siliceous.	2. Basic	1. Siliceous.	2. Basic.
Silica, ...	71·0	51·5	62 to 78	45 to 58
Alumina, ...	16 0	16 0	11 to 20	11 to 20
Potash, ...	4·5	1·0	3 to 6	¼ to 3
Soda, ...	2·5	3·0	1 to 6	1 to 6
Lime, ...	1·0	8·0	½ to 2	5 to 12
Magnesia, ...	1·0	6·0	⅓ to 2	3 to 12
Oxides of Iron and Manganese.	2 5	13·0	½ to 4	7 to 20
Water, Fluorine, Carbonic Acid.	1·2	1 3	¼ to 3	⅓ to 4
Specific gravity of Rocks, viz.:—				
1st, Natural, ...	2·65	2·95	2·4 to 2·7	2 8 to 3·2
2nd, Vitrified artificially,	2 40	2·72	2·35 to 2·40	2·5 to 2 84

"By combining the results I have obtained by chemical and mechanical analysis with those of analysis already published by various mineralogists, I have established, that igneous rocks of crystalline texture, and almost all compact or vitreous masses, formed by fusion, and wrongly considered as minerals, are derived from one or other of these Magmas. To the first are referable all the Granitic rocks, including the Eurites, Quartziferous Porphyrics, and Petrosilex, the Trachites, Phonoliths, Perlites, Obsidians, Pumices, and Lavas, with Vitreons Felspar. To the second belong the Diorites, Ophites, Euphotides, Hyperites, Melaphyres, Traps, Basalts, and Pyroxenic Lavas."—*Essay on Comparative Petrology. Annales des Mines*, vol. xi. 1857.

The two onter layers of onr cooled globe, to which Durocher applies the terms Acid and Basic Magma, respectively, may be conveniently designated as the First and Second Layer; and in one form or another, Durocher's hypothesis is now generally accepted by physical geologists. In its chemical view of the igneous rocks it is not original, as a similar proposal to regard all igneous rocks as the result of the mixture of two types of rocks was published long ago by Bunsen, and very generally adopted by German geologists; but in its physical view of these type rocks, as the outer and inner layers of the globe, by virtue of their relative specific gravities, it is Durocher's own, and justifies his claims to be regarded as one of the most brilliant and ingenious of geological investigators. I adopt Durocher's speculation, as I do that of Laplace, as a convenient hypothesis, summing up, in a form easily remembered, a crowd of concurrent facts, and being as near an approach as the limited knowledge of man can make to probability, in the obscure region of science with which it deals.

It is impossible for us, however, to remain contented with an hypothesis as to the composition of the First and Second layers of our globe, without speculating also as to the composition of the Third and Fourth layers; and, although it must be admitted that the deeper we descend, the less basis we have for our speculations, I will venture to make an additional guess, at least, as to the composition of the Third, and even of the Fourth layer of our globe. If we examine the composition of the Acid and Basic Magmas of Durocher with regard to the quantity of oxygen which they each contain, we shall find this difference, that the Acid Magma, or Outer Layer, contains 48·22 parts of oxygen in 100 parts of rock, while the Basic, or Inner Layer, contains only 43·60 parts per cent.* Now, we know, from mining operations, that lodes, which are simply fissures in the ground, are filled with their mineral wealth from below, in the form of sulphurets, arseniurets, and other minerals, containing no oxygen whatsoever; while they owe their oxides, hydrates, carbonates, arseniates, and phosphates, to the oxidizing influences to which they are exposed from above. From this consideration alone, it would appear probable that below the region of Durocher's Basic Magma, there must exist in the earth a region, or layer, filled with sulphur salts of metals, into whose composition no oxgen enters. This conjecture is further confirmed by the consideration of the chemical composition of aeroliths, which, as is well known, may be divided into two classes, meteoric irons, and meteoric stones, the former of which contain no oxygen, and the latter contain of oxygen, a quantity (not more than 22 per cent.) much less than the per centage of even the Basic Magma of Durocher. These meteorites, which are of interplanctary origin, must be admitted by those who adopt Laplace's nebular hypothesis to give us some evidence as to the composition ot the interior of our own globe.

It may therefore, be regarded as a speculation, in favour of which something may be said, that the first layers of our globe, in a descending order, are—

First Layer.—The Siliceous, or Acid Magma of Durocher.

Second Layer.—The Lime Magnesia and Iron, or Basic Magma.

Third Layer.—The region of the Sulphur and Arsenic Salts.

Fourth Layer.—The region of the Iron and Nickel Alloys.

If we turn our attention from the interior of the earth to its surface, we shall find a class of facts awaiting our attention, no less worthy of our notice. The envelope of our globe consists of water, oxygen, carbonic acid, and nitrogen; of which the two former are called on to play a most important part in the Mineral Kingdom, while it would be no exaggeration to assert that the presence of the two latter is the essential condition requisite to the possibility of the existence of the Vegetable and Animal Kingdoms, respectively.

In a planet whose atmosphere contained no oxygen, the most beautiful forms of the Mineral Kingdom would be wanting; the Sulphates, Phosphates, Silicates, could not exist; and unless water were present as well as oxygen, our beautiful Zeolites, and other hydrated minerals, would be absent.

* *Quantity of Oxygen contained in the Acid and Basic Magmas.*

	Acid Magma.			Basic Magma.	
	Per cent.	Oxygen.		Per cent.	Oxygen.
Silica, ...	71·00	36·86	.. .. ..	51·50	26·50
Alumina, ...	16·00	7·47	.. .. ..	16·00	7·47
Potash, ...	4·50	0·76	.. .. ..	1·00	0·17
Soda, ...	2·50	0·64	.. .. ..	3·00	0·76
Lime, ...	1·00	0·28	.. .. ..	8·00	2 27
Magnesia, ...	1 00	0 40	.. .. ..	6 00	2·40
Iron (peroxide), ..	2 50	0·75	.. (Protoxide)	13·00	2·88
Water, ...	1·20	1·06	.. .. ..	1·30	1·15
Totals, ..	99·70	48·22		99·80	43·60

MONTHLY NOTES.

MARINE MEMORANDA.

The *China*, iron screw steamer, has just been added to the Canada fleet, by Messrs Napier, of Glasgow. She is 326 feet long, 40 feet 6 inches beam, and 27 feet 6 inches deep. Her gross tonnage is above 2,500 tons; and she has oscillating geared engines of 550 horse power. On her trial in the Clyde, she performed 17 miles within the hour.

The South-Eastern Railway Company, in anticipation of increased passenger traffic during the Exhibition, have given orders for a sister vessel to the steamer *Victoria*, which was put on the Folkestone and Boulogne station last season, and has proved to be the fastest steamer afloat. The new boat is to be built by Messrs Samuda Brothers, the engines by Messrs Penn & Son, the builders and engineers of the *Victoria*, with such improvements as experience with the *Victoria* has suggested. When this steamer is on the station, the South-Eastern Railway Company will have three very powerful new vessels, performing the voyage from Folkestone to Boulogne in about an hour and a-half, or three-quarters of an hour less time than by their older boats.

Naval Congress for 1862.—The Naval Congress convened annually in London under the auspices of the Institution of Naval Architects, of which the Right Hon. Sir J. S. Pakington, Bart, G.C.B., is the President, was held this year at the Hall of the Society of Arts (kindly lent for the purpose), on the 27th, 28th, and 29th of March. The business commenced with a Report from the Council, after which, the first day was devoted to the discussion of the Steering and Sailing Qualities of Ships of War, the construction and armour of iron-plated ships, and the preservation of the bottoms of iron ships from fouling. The morning following was devoted to the consideration of the rolling motion of ships, and of the propulsion of steamers. In the evening the very important subject of the deraugement of the compass in iron ships generally, and especially in iron-cased ships, was explained and experimentally illustrated. On Saturday, a number of miscellaneous papers were read, on the American Stevens' Battery, the construction of Marine Steam Boilers, the Ventilation of Steamers, Submarine Explosive Shells, &c. We hope to give an abstract of these papers, or some of them in our next part.

A new and promising steam marine project has just been developed in London, under the title of the "China and Japan River and Sea Steam Navigation Company." This scheme proposes to take advantage of the intensely commercial spirit to be found in Chinese and Japanese waters, by running lines of light draught steamers on the coast waters, and large rivers of those parts. Two ships for the new line have been built at Liverpool, by Messrs Laird, and a third, the *Nergus*, at Millwall, by Messrs Mare. The *Nergus* is of about 1,000 tons burden, and she draws from 6 to 10 feet, according to her cargo. She has oscillating engines of 200 horse power nominally, and she carries two carronades on her forecastle. Her ascertained speed is 12 knots. Projects of this nature can hardly fail to develop enormous traffic in the selected locality, for we have, as yet, done literally nothing in this way in the vast commercial field of China.

At a recent proof trial of the *Neptune*, a paddlewheel steamer of about 350 tons and engines of 100 nominal horse-power, built by Robert Napier and Sons, of Glasgow, for plying between that city and Rothesay, the very high speed of 17·63 knots, or 20·275 statute miles per hour was attained on the course between the Cumbrae and Cloch Lights; and this speed was approximately confirmed by two runs subsequently made before the measured mile in the Gareloch, which gave a mean rate of 20·059 statute miles per hour. This, it is believed, is the highest speed through the water as yet attained on this side the Atlantic by any vessel of so limited a size. It is held to be mainly attributable to the superiority of form derived from the very high proportinate dimensions which have been adopted. Her Majesty's yacht is a vessel of 2,000 tons, with engines of 600 nominal horse-power, and attains her 17 knot speed on proportionate dimensions of 7½ times her breadth to length. The new Holyhead boats are vessels of upwards of 2,000 tons, with engines of 700 nominal horse-power, and attain their 18 knots speed on proportionate dimensions of eight times their breadth to length. The *Neptune* is 200 feet in length, with 18 feet 6 inches beam, and, notwithstanding her comparatively small size, her 17 knots speed, also speaking roundly, has thus been attained on proportionate dimensions of 10¾ times her breadth to length—the highest as yet ventured on, it is believed, in this country. The engines are of 40 inch cylinders, with a stroke of 3 feet 6 inches, and the speed of piston at the *maximum* of 72 revolutions amounted to 504 feet per minute.

MISCELLANEOUS.

Horse Railways in Switzerland.—The Council of State of the canton of Geneva have granted a concession for the construction of horse railways in the canton, to Mr Charles Burn, C.E., the author of the treatise "On the Construction of Horse Railways for Branch Lines and for Street Traffic." A commencement is to be made by constructing a line from Geneva to the small town of Carouge, two miles distant. It is understood that the works have already commenced, and that the first line will be opened for traffic on the 1st of May next. Mr Burn will lay down his patent grooved rail. The carriages will be constructed on the American system, and are now being built at the Street Rail Car Works at Birkenhead.

Locomotive Engine Building in France — The well-known French engineering firm of Creuzot, so favourably known for its heavy work in sugar mills and engines, has in hand at present no fewer than sixty-one locomotive engines for the Madrid, Saragossa, and Alicante railway, the great leading railway of Spain, in which country so much is now doing in the extension of internal conveyance communication. No fewer than fifty-one of these engines are designed for French goods traffic. Of this enormous order twenty-one have been delivered this year, and thirty fall to be turned out next year, whilst the remaining ten are to be executed in 1863. By the end of that year, the stock of this great line will amount to 242 locomotives, 602 carriages, and some 3,000 trucks.

We have recently mentioned one or two engineering successes with new artesian wells; and it is satisfactory to us to know that what we then said as to the strong probability of the system growing far more valuable than had hitherto been calculated upon, has been most strongly confirmed in the instance of the new well of the Royal Horticultural Society. For a long time, the question as to how to supply water for the new gardens at South Kensington, with their basins, canals, and fountains, gave the society the greatest concern; and having doubts as to what an artesian well could do for them, Messrs Easton & Amos, of Southwark, offered to sink a well on their own responsibility. This they have done, and there is now a well at the gardens, 401 feet deep, supplying far more than the 75 gallons per minute, as required and guaranteed. It is believed, indeed, that the new well could supply a million gallons in the twenty-four hours, if the machinery necessary was enlarged. The construction is that of an actual well down to a depth of 226 feet, and below that a bore of 175 feet

Birmingham Agricultural Show.—Birmingham, with its now well-known Bingley Hall, the dense centre of the manufacture of nearly everything metallic; where brass work of all kinds jostles steel pens; where stamped metal and electro-plate is mingled with copper tubes, die sinking, buttons, bedsteads, and glass; Birmingham, we say, has gradually grown into pre-eminent fame in its shows of cattle, poultry, dogs, and farming mechanism. This year, its thirteenth exhibition proves to be livelier than ever, for many new exhibitors have come forward in competition with those who have there won renown before, and to try what they can do in carrying off some of the handsome pecuniary prizes, the *médailles d' honneur*, or the nine magnificent cups.

Cotton.—Algiers, too, is now under view with reference to its capabilities as a cotton-growing country, and an Algerian cotton company has actually been started on a large scale. The French government has always found Algiers an expensive bargain; perhaps something good will now come of it, as there can be little doubt that cotton may be grown there to advantage. The promoters of the new subject, have obtained a grant of a large tract of good land from the French crown, and they propose to embark £1,000,000 in working it. A commission accredited by the French government to that of Algiers, has been despatched from this country, to select the most appropriate sites in the province of Oran, Constantine, and Alger, and Manchester and Liverpool are being stirred up to show their adherence to so promising a project. We already know that Algeria can produce cotton quite equal to the finest grown in the Southern States of America. Labour there is free, and it is cheap and abundant, and the soil and climate are both well fitted for the cotton crop. Freights too are but one half of those from America, and the passage to Liverpool averages only nine days. In proof of what can be done with Surat cotton, we may mention that there are mills at work in this country where there is not a bale of American cotton at present, and where good 30s twist, and all counts from 32s to 38s weft are regularly spun entirely from the Indian material. In one special instance a high class is spun up to 40s, from Surat alone. The fact now appears to be clear, that with plenty of good East Indian cotton, there will never be a dearth of good medium counts of yarn.

Science and Art.—Photographs for the Magic Lantern.—Long as photography has been before us in a practicable and appliable form, we are even yet at a very early stage of its positive application to every-day practical purposes, we have yet to bring it to bear upon an apparently endless variety of subjects to which the finger of science has long since pointed, and it is only by degrees that we can hope to reach even a portion of the applications now arrived at. Mr Highley the publisher of Dean street, Soho, is now doing something in the way of forwarding the progress of the art, in the publication of a series of photographic transparencies for the magic lantern on scientific and artistic subjects. Mr Highley has long felt that this mode of illustration would be invaluable to the lecturer on natural history or art, as photography furnishes an exact representation, even to the most minute detail, of natural subjects; but yet it remains to place within the reach of the astronomer, geologist, botanist, zoologist, anatomist, pathologist, microscopist, and art teacher, a judiciously selected series of views suited for class illustrations. The art subjects selected for publication will present a facile means of simultaneously familiarising youth with the plot of many of the standard works of favourite authors and "the style" of artists who have gained a world-wide recognition (as may be instanced by the photographs of Kaulbach's illustration to Gœthe's Reineke Fuchs), and thus induce a desire in many to become familiar with the works themselves. These photographic views will, for ordinary sale, be produced on glasses three and a half inches square, and be included within a disc of three inches diameter, that being the standard gauge for the best class of magic lanterns at present in use, but they can be supplied of larger or smaller diameter to special order.

Doubling Silk Threads.—A highly important improvement has just been effected in the manufacture of three-cords lace and fringed silk, by means of a very peculiar system of doubling the threads, and of a machine adapted for performing this operation. This ingenious process originates with the house Beaux Mahistre and Rousset, of Avignon, who are successfully working the patent in France. The entirely fresh circumstances arising from the commercial treaties prevent our intelligent and active manufacturers from viewing with indifference the progress made in a neighbouring country, especially when that country is France, whose genius alone, perhaps, is able to compete with ours. The method hitherto employed to double three-threads silk cord consists in joining three-threads previously twisted or spun, taken from three separate bobbins. If these three-threads are not of precisely the same twist, and of precisely equal sizes and also perfectly stretched, to obtain which is extremely difficult and almost impossible—great lengths without knots being the object in view—the consequence is that, instead of producing a smooth, even thread, a faulty one is obtained, technically called "cork-screwy;" that is to say that, where these threads are not of equal size and tension, they do not join well together, and form a uneven surface, similar to the edge of a saw. The system of doubling of which the patent treats remedies these defects, by taking a single thread and doubling it into three, making a continuous chain, the loop composing the chain coming at distances of four or six feet more or less. It is easy to see that one and the same thread doubling on itself continuously in this way will be more equal in size and tension than a three-cord silk produced from three different threads, and worked in great lengths. The operation of this patent, besides securing a good result from a comparatively inferior material, enables one to obtain indefinite lengths with no other knots than those which arise from the end of a bobbin, or from accidental breakage. It furnishes, moreover, an article free from "corkscrew," which hitherto has been the great difficulty in *cordonnets* of great length. The freedom from knots and "corkscrews," combined with evenness and length of thread, is a great advantage in certain processes of manufacture, more particularly so in the making of machine lace and cord for sewing-machines, which are becoming more and more generally used. We understand the machine effecting the doubling alluded to is inexpensive, and is managed by one woman, without the aid of either steam or any other motive power. The quantity of work which can be accomplished by one machine varies from 6 to 10lbs. per day, according to the size of the silk used.

The Utilisation of Waste Caoutchouc or India Rubber.—It has all along been supposed that India rubber once vulcanized or indurated, and manufactured, could never be re-manufactured or worked up in such a manner as to render it commercially available for secondary use. Science has, however, recently shown us that the otherwise waste material can be worked up to advantage; and that a most important new branch of economy in the India rubber manufacture can thus be secured. This is no speculation; it is a well ascertained fact, and the commercial process has now been fully organized, and settled into working shape, by a company under the style of the "London India Rubber Company," who propose to carry out the plans covered by three several patents of July and November, 1858, and May, 1859, at extensive works at West Ham, Essex; the capital of the Company is £75,000, in 7,500 shares of £10 each, and the practical working of the plans is under the im-

mediate direction of Mr Stephen Moulton, of Kingston Mills, Bradford, Wilts, well known as a highly scientific manufacturer of India rubber, of long experience. India rubber, although it has been developed as a material for manufacturers, within so recent a period, we may say indeed, within the last twenty years, has been introduced to such a vast extent, and applied to such an enormous variety of purposes that the waste or worn ont material has become so very abundant as to have rendered the question of its utilization a matter of the most serious consideration for some years. After a large amount of scientific research, the process of re-manufacture has really been reduced to a very simple matter. The waste material is primarily reduced or disintegrated as finely as practicable, by means of beated "mullers," or rollers, and it is then subjected to the action of heat, either dry or moist heat being used. This treatment brings the material to a plastic or softened condition, and it can then be at once worked up as required, for the production of new goods, either alone, with the admixture of a proportion of raw gum or rubber, or with asphalte, rosin, pitch, coal tar, shell-lac, or other bituminous or resinous substances, palm oil, sulphur, lead, magnesia, lime, zinc, and earths or clay, separately or in combination, may also be added. Where cloth or fibrous materials are mingled with the waste rubber, such matter can be easily destroyed without injuring the rubber itself, by the agency of an aqueous solution of lime or alum, or a dilute aqueous solution of sulphuric acid. But it has been found in actual practice that such fibrous matters, do not usually interfere with the value of the rubber, but, in fact that when incorporated with the plastic mass, they add strength to the material. This new system of manufacture has long been successfully practised in the United States, by two of the largest companies there. The new works are intended to commence with the manufacture of such articles as mill banding, packing valves, buffers, and generally all such articles as are directly connected with engineering, mechanical and manufacturing purposes. All such things can be produced by a mixture of about 70 per cent. of the waste material, and 30 per cent. of the raw gum. The waste material is obtainable at £17 or £18 a ton, whilst the new raw gum costs from £125 to £150 a ton. Hence if the quality of the articles manufactured from the waste material is at all fair, and there seems no reason to doubt that they will be so, the economy of the process is very evident, and the new manufacture cannot but have a most important bearing upon all processes or channels of use where India rubber enters.

CRINOLINE FASTENER.—The prevailing fashion of distended skirts has called into play the inventive faculties of many mechanical minds. Attention has long been turned to the rolling and preparing of what is called "crinoline steel," tons of which are produced every week at Sheffield; but now another want is required to be met, namely—a simple and easy means of securing the two ends of the steel bands when made up into the "*crinoline*." Several patents have been granted to different manufacturers for contrivances for this purpose, but the most recent and best which we have seen is one invented and

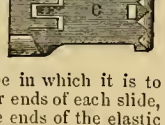
Fig. 1.

patented by Messrs Myers and Son, of Birmingham. Fig. 1 of the annexed engravings is a side elevation of the improved fastener. Fig. 2 is a longitudinal

Fig. 2.

horizontal section of the same, and fig. 3 is a separated detail of one of the holders detached. A is a flattened tube of thin steel, stamped up and turned over at the sides, so as to form a socket for the reception of the two contiguous ends of the steel band or "crinoline," D D. Within this tube at each end slides a claw or holder, C, (fig. 3), also stamped up out of thin sheet steel. The outer end of the claw is notched or serrated, and turned over or hooked, whilst its other end, which slides within the flattened tube, has a portion turned over on each side so as to enable it to fit accurately the tube in which it is to slide. A notch or opening is made near the inner and outer ends of each slide, into which are engaged small catches, formed at *a*, *a*, on the ends of the elastic tongues, B, made in one piece with the flattened tube. These catches spring into the inner notches or openings when the slides are slid outwards, as shown at the right hand of fig. 1, and engage with the outer ones when the slides are pushed inwards, as shown at the left hand of fig. 1, in both cases serving to retain the slides in their places. In order to insert the ends of the steel band or crinoline, the slides, C, must be first drawn out, and then the ends of the band are laid against the claws, and the slides, with the ends of the band, are pushed inside the tube, A, until the catches, *a*, drop into the outer notches or openings, and thereby retain the slides until relieved by lifting the tongues, B. The ends of the steel band are firmly retained inside the tube, A, by the serrated claws of the slides, which penetrate the lapping or outer covering of the steel band, and effectually prevent the withdrawal of the ends of the band. One important advantage afforded by this little contrivance is the ease by which the ends of the steel band can be removed should the band become damaged or broken, it being simply necessary for that purpose to draw out the slides, C, when the end of the band may be readily removed and replaced by another—a desideratum obtained by no other manufacture of the kind.

Fig. 3.



PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING MARCH 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	d.	£	s	d	£	s.	d.	£	s.	d.
Bars, &c., British, per ton,	5	15	0	5	15	0	5	15	0	5	15	0
Nail Rods,	6	10	0	7	5	0	7	5	0	7	5	0
Hoop,	8	0	0	8	0	0	8	0	0	8	5	0
Sheets,	8	10	0	8	10	0	8	5	0	8	10	0
Pig, No 1, Wales,	3	8	9	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	10	0	7	0	0	7	0	0
Rails,	5	7	6	5	7	6	5	7	6	5	7	6
Pig, No. 1, Clyde,	2	19	0	2	12	0	2	6	0	2	9	6
Swedish in bond,	11	15	0	12	0	0	11	5	0	11	10	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	10	0
In faggots,	17	10	0	17	0	0	18	0	0	18	10	0
SPELTER, ingot,	17	15	0	17	15	0	18	0	0	18	5	0
ZINC, sheet,	23	0	0	23	0	0	24	0	0	26	0	0
COPPER.												
Sheathing bolts, pr lb.,	0	0	10½	0	0	11½	0	0	11	0	0	11
Bottoms,	0	1	0½	0	1	0½	0	0	11	0	0	11½
Old,	0	0	9¼	0	0	9	0	0	9	0	0	9½
Tough Cake, per ton,	112	0	0	100	0	0	98	0	0	98	0	0
Tile,	102	10	0	103	0	0	95	0	0	98	0	0
TIN.												
English blocks, per ton, duty free,	120	0	0	120	0	0	120	0	0	120	0	0
Bars in barrels,	121	0	0	121	0	0	121	0	0	121	0	0
Refined,	122	0	0	122	0	0	122	0	0	122	0	0
Banca, in bond,	124	0	0	125	0	0	124	0	0	124	0	0
Straits, ditto,	117	0	0	118	0	0	118	0	0	117	0	0
TIN PLATES.												
Char. IC, per box,	1	7	0	1	9	0	1	7	0	1	9	0
Coke. IC.	1	2	6	1	3	0	1	2	0	1	12	0
LEAD.												
English pig,	21	0	0	20	5	0	20	0	0	19	15	0
Sheet,	20	10	0	21	0	0	20	10	0	21	0	0
Spanish pig, in bond,	19	10	0	19	15	0	19	10	0	19	0	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	15	0
Quebec, red pine,	3	15	0	4	10	0	4	0	0	0	0	0
" yellow pine,	3	0	0	3	0	0	3	15	0	4	0	0
St. John, N.B., yellow,	5	0	0	5	10	0	5	10	0	5	5	0
Quebec, oak, white,	5	0	0	5	10	0	5	5	0	5	10	0
" Birch,	3	10	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	0	0	4	10	0
" Fir,	4	5	0	4	0	0	4	5	0	4	5	0
Memel fir,	3	10	0	4	0	0	4	0	0	4	0	0
Riga,	3	5	0	3	10	0	3	10	0	3	5	0
Swedish,	2	15	0	3	0	0	2	14	0	2	18	0
Deals, per C, 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	0	0	15	0	0	16	0	0
St. John, white spruce,	15	0	0	15	0	0	15	0	0	16	0	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	17	10	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	10	0
Archangel yellow,	13	0	0	13	10	0	13	0	0	13	0	0
St. Petersburgh yellow,	12	0	0	12	10	0	12	0	0	12	0	0
Finland,	9	0	0	9	0	0	9	10	0	10	0	0
Memel,	12	0	0	10	0	0	12	0	0	12	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	0	0	11	0	0
" white,	9	10	0	9	10	0	10	0	0	9	10	0
Gefle, yellow,	10	0	0	10	0	0	10	0	0	10	0	0
Soderhamn,	10	0	0	10	10	0	10	10	0	10	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	23	0	0	23	0	0	24	0	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	22	10	0	22	10	0	22	0	0	22	0	0
White Lead,	26	10	0	26	10	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	41	10	0	42	0	0	41	0	0	40	0	0
" yellow,	34	0	0	35	0	0	34	0	0	36	0	0
Sperm,	93	0	0	93	0	0	93	0	0	93	0	0
Cod,	39	3	0	39	10	0	39	0	0	39	0	0
South Sea,	36	0	0	36	0	0	35	0	0	36	0	0
Olive, Gallipoli, per tun,	56	10	0	57	0	0	57	0	0	57	0	0
Palm, per tun,	43	0	0	43	10	0	43	0	0	43	10	0
Cocoa-nut,	49	10	0	50	10	0	50	0	0	50	0	0
Rape pale foreign,	49	8	0	49	10	0	49	0	0	49	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	24	0	0	24	10	0	25	0	0	25	0	0
Jute,	14	0	0	14	0	0	14	0	0	14	0	0
Hemp Rope,	24	10	0	24	0	0	24	0	0	24	5	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

31st December, 1861.

3260. William Tongue, Chryssell Road, Brixton—Woven looped and bobbin net fabrics.
3261. Andrew Macnair, Southampton Buildings, Chancery Lane—Axle boxes for railway carriages.—A communication.
3262. William Tongue, Chryssell Road, Brixton—Umbrellas and parasols.
3263. Thomas Green and Willoughby Green, Smithfield Iron Works, Leeds, and Robert Mathers, Trafalgar Street, Leeds—Chains for chain wheels, and in giving motion to machinery.
3264. Neil M'Haffie, Summer Street, Mile End, Glasgow—Ventilators or valves.
3265. Thomas Pickford, Fenchurch Street—Manure.
3266. Frederick Tolhausen, Paris—Covering springs.—A communication.
3267. William Spence, Chancery Lane—Deflectors for lamps.—A communication.
3268. John Haslam, Preston—Winding, holding, and letting go cords, bands, or chains.
3269. William H. Bailey, Salford—Sewing machines.
3270. William E. Newton, Chancery Lane—Motive power from explosive compounds.—A communication.
3271. William E. Newton, Chancery Lane—Boring rocks.—A communication.
3272. Eugene Tiphagne, Paris, and Dominique Delbosque, Nogeut-sur-Marne, France—Advertisements.
3273. Joan B. T. Cretal, Saint Malo, France—Colouring smoking pipes.
3274. Edward T. Hughes, Cbancery Lane—Saddles.—A communication.
3275. Richard A. Brooman, Fleet Street—Revivifying animal black or charcoal.—A communication.
3276. Alexander Edward and James Edward, Dundee—Spinning.

1st January, 1862.

1. John M. Rowan, Glasgow—Railway wheels.
2. Nicolas C. Szerelmey, Brixton—Leather cloth.
3. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow.—Hose pipe joints or couplings.—A communication.
4. Thomas Hall, Odiham, Hants—Removing weeds from canals.
5. John Walker, City Road—Forts and fortifications.
6. Thomas C. Clarke, Liverpool—Heating and circulating water.
7. John Bradbury, Pendleton, near Manchester—Self-acting mules.
8. Richard A. Brooman, Fleet Street—Shears or scissors—A communication.
9. Richard A. Brooman, Fleet Street—Propelling vessels.—A communication.
10. William Bush, Tower Hill—Omnibuses and other carriages.
11. Benjamin Rhodes, Old Ford, Bow—Pipes and vessels of various shapes.
12. Edward Banfield, Ilfracombe, Devonshire—Lubricating axle journals and brasses.
13. William B Patrick, Highgate, Middlesex—Sugar.
14. Edmund F. Davis, Tavistock Square, Middlesex—Gas burners.
15. James Howard and Edward T. Bousefield, Bedford—Steam cultivation.
16. William E. Newton, Chancery Lane—Coffee pots and boilers for culinary purposes.—A communication.
17. John J. Gutkuecht, Neuhof, Switzerland—Meters for measuring gas, &c.

2d January, 1862.

18. William E. Gedge, Wellington Street, Strand—Roasting Coffee.—A communication.
19. Athanaso M. P. Airiau, Paris—Lute organ.
20. William A. Fell, Windermere, Westmoreland—Bobbins.
21. Matthew Cartwright, Carlisle—Artificial teeth.
22. George Jeffries, Norwich—Breech-loading fire-arms and cartridges.
23. Hermann Escbwege, Mincing Lane—Treating wood and otber vegetable spirit.

3d January, 1862.

24. Edward Nugent, Brooklyn, New York—Fire-arms.
25. Gilbert Stracey, Rackheath Hall, near Norwich—Artificial fuel.
26. Francois S. Belloche and Herman Bollack, Paris—Parasol.
27. William E. Gedge, Wellingtou Street, Strand—Cleaning or sifting grain.—A communication.

4th January, 1862.

28. James W. Arundell, Old Broad Street—Dressing ores and minerals.—A communication.
29. James W. Arundell, Old Broad Street—Removing impurities from coal.—A communication.
30. James W. Arundell, Old Broad Street—Ventilators.—A communication.
31. Christopher Cross, Stratford, and Edward Padmore, Manchester—Piled fabrics.
32. Richard H. Cotter, Cambridge Heath, Middlesex—Permanent light.
33. George Leyshou, Tividale, and David Beckley, Brockmoor, Staffordshire—Breaks.
34. James Howden, Glasgow—Steam engines and boilers.
35. Henry D. Pochin, Salford, Lancashire—Soap or size.
36. George T. Bousfield, Loughborough Park, Brixton—Propelling water craft—A communuication.
37. Arthur Warner, Threadneedle Street—Purifying coal gas.

6th January, 1862.

38. John Coryton, Chancery Lane—Type machine.
39. Alfred V. Newton, Chancery Lane—Cigars.—A communication.
40. George Betjeuann, George W. Betjemann and John Betjemann, Pentonville, Middlesex—Dressing cases.
41. Patrick B. O'Neill, Hart Street, Bloomsbury—Screw wrenches or spanners.
42. William T. Kite, Mongewell Mill, Wallingford—Starch.
43. Frederick Brown, Luton, Bedfordshire—Kitchen ranges and cooking apparatus.

7th January, 1862.

44. Frederick Shaw, Sheffield—Stopping railway trains.
45. James Higgins and Thomas S. Whitworth, Salford—Spinning and doubling.
46. John Tatham, Rochdale, Lancashire—Spinning and doubling.
47. Benjamin Foster, Denholme Mills, Yorkshire—Spinning and doubling.
48. Arthur Wallis and Charles Haslam, Basingstoke, Southamptonshire—Rotary screens.

8th January, 1862.

49. David Beale, Cobden Street, Middlesex—Fastening iron plates to ships.
50. Louis Wunder, Liegnitz, Prussia—Soap.
51. Anthony Heath, Islington—Inkstands.
52. Samuel Jesson, James Batson, yr., Smethwick, Staffordshire, John Moore, yr., Langley, near Oldbury, and James Roberts, Smethwick—Gun barrels and wrought-iron tubing.
53. Charles Pilkington and Thomas Pilkington, Sheffield—Skates.
54. Joshua Barber, Preston—Hand mules.
55. John Stenhouse, Barnsbury Road, Middlesex—Rendering certain substances less pervious to air and liquids.
56. Henry Bessemer, Queen Street Place, New Cannon Street—Malleable iron and steel.
57. William Bradshaw, yr., Coventry, Warwickshire—Watches.
58. Henry Cook, Manchester—Electricity.—A communication.

9th January, 1862.

59. Charles W. Siemens, Great George Street, Middlesex—Insulating telegraph wires.
60. James Smith and Stephen Wellstood, Glasgow—Cooking stoves or ranges.
61. John Brunt, Paris—Gas meters.
62. Thomas A. Weston, Birmingham—Cranes, windlasses, capstans, and presses.
63. David Wilson, Colombo, Ceylon—Preparing coffee.
64. Henri Charvet, Lille, France—Spinning cotton.
65. David Wilson, Colombo, Ceylon—Hydraulic presses
66. Joel H. Tatum and William J. Williams, Bridge Street, Blackfriars—Candles and wicks.
67. Richard A. Brooman, Fleet Street—Gas.—A communication
68. Benjamin Thompson, Birmingham—Ordnance fire-arms, and projectiles.—A communication.
69. Harby Barber, Belgrave, Leicestershire—Safety lamps.

10th January, 1862

70. Alphonse Rene Le Mire de Normaudy, Odin Lodge, King's Road, Surrey—Tubes.
71. John Carter, Tipton, Staffordshire—Draining plough.
72. Robert Johnson, Liverpool—Coating the bottoms of iron ships.
73. Montague Wigzell, Topsham, Devonshire—Ventilator.
74. Frederick Moores, Warrington, Lancashire—Motive power.
75. James Oates, Mirfield, Yorkshire—Washing machines.
76. Henry Darvill, New Windsor, Berks—Chalk for building purposes.
77. William H. Preece, Southampton—Signalling.
78. Louis Petre and Edward S. Tucker, Waterloo Road—The application of materials for advertising boards.
79. John Kenyon, Ivy Cottage, Hampstead, and Archibald Horn, Great James Street, Middlesex—Railway Signalling by electricity.
80. William Clark, Chancery Lane—Steam.—A communication.

11th January, 1862.

81. Thomas Ramsay, Newcastle-upon-Tyne—Coke.
82. Henry Charlton, Birmingham—Shoes for mules and horses.
83. Joseph White, Southwark, Surrey—Lubricating or oil cans.
84. Lauchlan Mackirdy, Greenock, Renfrewshire—Reburning animal charcoal.
85. Thomas Scott, Nelson Square, Surrey—Steam engines.
86. William Wilkinson, Bayswater, Middlesex—Ornamenting metals, glass, porcelain, skins, and protecting silver and gold on said materials.

13th January, 1862.

87. Anthony G. Southby, Bulford, Wiltshire—Pulp for paper making.
88. John M. Rowan, Glasgow—Iron and steel.
89. Thomas Gilbert, Charles Gilbert, and Thomas Haddon, Birmingham—Swivels for guns.
90. Ferdinand C. Warlich, New Cross, Kent—Artificial fuel.
91. Thomas Soar, Nottingham, Jonathan Belshaw, Radford, Nottingham, and Marcus Soar, Nottingham—Knocker to be attached to doors, shutters, or other parts of premises for the reception of letters.
92. John Parker, Bradford, Joseph Wells and Benjamin Wells, Bowling, near Bradford, Yorkshire—Steam engines, boilers, and furnaces.
93. William E. Gedge, Wellington Street, Strand—Motive power.—A communication.
94. Richard A. Brooman, Fleet Street—Cups, bowls, and saucers.—A communication.
95. Henry Schottlander, Paris—Photographie albums.
96. George Hewitt, Ipswich—Drain tiles.
97. Joseph Betteley, Liverpool—Ship building.
98. Thomas W. G. Treeby, Paddington, Middlesex—Cannon and fire-arms.
99. James G. Marshall, Leeds, Yorkshire—Preparation of flax.
100. Charles N. May, Devises, Wiltshire—Pastry.

14th January, 1862.

101. John Carter, Chelsea—Shaft tug or bearer used in harness.
102. Ebenezer W. Hughes, Parliament Street, Westminster—Engineering and architectural structures.
103. James Paine, Manchester—Printing and ornamenting fabrics.
104. James Jack, Liverpool—Moulding or shaping metals.
105. Matthew Chadwick, Radcliffe, Lancashire—Folding or platting cloth.
106. William Gorse, Minworth, Warwickshire—Cut nails called brads.
107. Samuel W. Marsh, Washington—Breech-loading fire-arms.
108. Thomas Harrison, Birmingham, and John G. Harrison, Kirby Ravensnorth—Ploughs.
109. Christopher Hill, Ferryside, Carmarthen—Lubricating compounds.
110. Josiah Harris, Newton Abbot, Devonshire—Target marker.
111. James G. Marshall, Leeds—Textile fabrics.

15th January, 1862.

112. Edward Lord, Todmorden, Yorkshire—Looms.
113. William Cleland, Liverpool—Gas.
114. Thomas Timmins and Thomas Simmons, Birmingham—A combination bath.
115. Joseph Ridsdale, Minories—Sheet lead.
116. Henry D. P. Cunningham, Bury, near Gosport, Hants—Screw propellers.

16th January, 1862.

117. John Brooke, Leeds—Lubricators.
118. John A. Knight, Chancery Lane—Millstones.—A communication.
119. Edward H. C. Monckton, Fineshade, Northamptonsbire—Motive power.
120. Thomas Matanle, Bethnal Green Road, Middlesex—Umbrellas, parasols, and sunshades.
121. William Tristram, Bolton, Lancashire—Power looms.
122. Henry Wheatcroft, Fore Street—Bonnet and cap fronts.

17*th January*, 1862.

123. Thomas Myers, Bloomsbury Square, and Edward Myers, Millbank Street—Preventing rust on metal surfaces.
124. Robert Dunlop, Cwm Avon Taibach, Glamorgau—Facilitating calculations.
125. John M. Rowan, Glasgow—Steam hammers.
126. Barrow Moss, Liverpool—Bricks and fire blocks.
127. Natban Thompson, St. Paul's Road, Camden Town—Stopping bottles.
128. Julius C. Dickey, Saratoga Springs, New York—Quartz crusher.
129. Rohert Romaine, Devises, Wiltshire—Steam boilers for agricultural and tractiou purposes.

18*th January*, 1862.

130. John Tow, Poland Street, Oxford Street—Stoves or fire places.
131. Thomas Emmott and Joseph Travis, Oldham, Lancashire—Piled fabrics.
132. Tbomas Newton, Manchester—Sight for rifles.
133. Edward Davies, Warrington, Lancashire—Soap.
134. William Helme, Caldbeck, Cumberland—Fire-lighter.
135. James J. Stevens, Southwark, Surrey—Point indicators.
136. William Tice, Downham Road, Islington—Gas regulators.
137. Samuel Dreyfous, Paris—Throstle spinning frame.—A communication.
138. William L Winans, Baltimore—Cannon or ordnance.
139. Thomas Roberts and John Dale, Manchester—Gunpowder.

20*th January*, 1802.

140. Walter S. Mappin, Birmingham—Lock.
141. Leouard Barbat, Paris—Hats and bonnets
142. Thomas Holt, Blackfriars Road, Surrey—Iron chairs and chair bedsteads.
143. Thomas W. Johling, Point Pleasant, Northumberlandshire—Locomotive engines in mines.
144. William Boaler, Manchester—Sizing paper yarns and woven fabrics.—A communication.
145. Andrew Lamb, Southampton, and John White, Isle of Wight—Life boats.
146 Joseph Bird. Blidworth, Nottingham—Crank axle.
147. Edward C. Nicholson, Locksfields, Surrey—Colours.
148. John W. Agnew, Windsor Chambers—Adjusting last.—A communication.
149. Robert O Doremus and Bern. L. Budd, New York—Making cartridges.

21*st January*, 1862.

150. John Stenhouse, Barnsbnry Road, Middlesex—Protection of metallic surfaces.
151. John A. Kuight, Chancery Lane—Permanent way of railways.—A coumunication.
152. Jean F. Tourrier, Manchester Square, Middlesex—Diffusion of heat in houses.
153. Christopher Binks, Gray's Inn, Middlesex—Generating steau.
154. John Bate, Birmingham—Corking or stopping bottles, jars, &c.
155. Henry B. Barlow, Manchester—Indicating the revolutions of shafts.—A communication
156. George T, Bonsfield, Brixton, Surrey—Nails and spikes.—A communication.
157. James H. Rawlins, Hope Paper Mills, near Wrexham—Paper.—A communication.
158. Alfred J. Martin, Bow, Middlesex—Fusel oil.
159. Richard A. Brooman, Fleet Street—Sweeping machincs.—A communication.
160. William Burgess, Newgate Street—Reaping machines.
161. Michael Henry, Fleet Street—Electricity to horology.—A communication.
162. William Tozer, Gracechurch Street, and Archibald Read, Walworth, Surrey—Boots and shoes.

22*d January*, 1862.

163. Louis Martin, Paris—Mineral oils.
164. Isaac Roberts, Liverpool—Hydraulic motive power engines and meters.
165. Francis W. Gerish, City Road, Middlesex—Printing presses.
166. Edmund Pace, Queen Street—Venetian blinds.
167. Alfred J. Beer, Canterhury—Valves.
168. Thomas Little and John Little, Alston, Cumberland—Cooling coffee berries.

23*d January*, 1862.

169. Joseph Hinks and Adam Dixon, Birmingham—Boot warmer.
170. Jonathan A. Mays, Regent Square, St. Pancras, Middlesex—Envelopes.
171. John Tomlinson, Liverpool—Washing machines.
172. John Wallace, Alexandria, Dumhartonshire—Reaping machines.
173. Frederick W. Werner, Mannhcim, Grand Duchy of Baden—Destruction of vermin.
174. William H. Ropes, Old Broad Strcet—Cleaning seed or grain.—A communication.
175. Henry Owen, Islington—Hosiery.
176. George Rogers, Staines, Middlesex—Letting off liquids from butts, vessels, or cisterns.
177. John C. Johnson, Nottingham—Twist lace.
178. Abraham Ripley, Lamheth, Surrey—Pistons.
179. Henry Yates, Cecil Street, Strand—Repairing iron rails
180. James G Service, Glasgow—Cutting and scoring pasteboard.

24*th January*, 1862.

181. Alexander W. Williamson, University College, London—Tubulous boilers or steam generators.
182. James Higgin, Manchester—Stopping railway carriages.
183. John Cornforth and Benjamin Smith, Birmingham—Boring or drilling.
184. William Clark, Chancery Lane—Artificial flowers.—A commnnicatiou.
185. John Longhnrst, Ticehurst, Sussex—Chains and cables.
186. James Rock, Hastings, Sussex—Carriages.
187. John W. Girdlestone, Birkenhead, Cheshire—Projectiles.
188. Timothy Morris and Robert Weare, Birmingham, and Edward H C. Monckton, Fineshade, Northamptonshire—Telegraphic commnnication.
189. Charles G. Hall, Regent Street, Middlesex—Boots, shoes, and leggings
190. Arthur Wallis and Charles Haslam, Basingstoke, Sonthampton—Thrashing machines.
191. John Alison, Brightland, Reigate, Surrey—Tilling land by steam power.

25*th January*, 1862.

192. Whitmore Baker, Downham, Norfolkshire—Fire arms.
193. William Johnston, Glasgow—Lamps.
194. Charles West, Derby Street, Westminster—Insulating wire.
195. Jean C. F. Mougin, Paris—Barcelonnettes or cradles.
196. John H. Johnson, Lincoln's Inn Fields, Middlesex, and Buchanan Street, Glasgow—Prevention of incrustation in steam generators.—A commnnication.
197. Dickinson Edleston and Henry Gledhill, Halifax—Textile fabrics.
198. Edwin A. Curley, Green Terrace, Clerkenwell—Sewing machines.
199. John Wright, Rochester, Kent—Constructing works below water.
200. Francois J. L. Lefort. Bothey, Belgium—Safety lock.
201. Frederick Roberts, Maiden Newcon, and Alexander Roberts, Frome Vauchurch, Dorsetshire—Cultivating laud.
202. John Brown and Joseph Davenport, Bolton, Lancashire—Lubricator.
203. Alexander Samuelson, Cornhill—Hydraulic presses.

27*th January*, 1862.

204. Walter Smith, Manchester, and Casimir Tiesset, Boulogne-sur-Mer, France—Colours.
205. Joseph Lillie, Duke Street, Adelphi, Middlesex—Coating the bottoms of vessels.
206. Samuel A. Carpenter, Birmingham—Crinoline or crinoline skirts.
207. Ralpb Martindale, Handsworth, Staffordshire—Globes and glasses for lamps.
208. Charles W. Harrison, Walworth, Surrey—Printing, stamping, embossing, and perforating.
209. William Orr, Greenock, Renfrewshire—Sugar.
210. Joseph Smith, Keighley, Yorkshire—Spinning and doubling fibrous materials.
211. William W. Warren, Milton, Gravesend—Providing a cheap and inexpeusive mode of interment.
212. Thomas J. Rohotham, Burslem, and Nathan Hackney, Hanley, Staffordshire—Purifying potters' materials.

28*th January*, 1862.

213 James List, Carisbroke, Isle of Wight—Obtaining distances and heights.
214. Henry H. Trepass, St. George's Terrace, Barnsbnry Park—Employment of the kaleidescope.
215. Stephen Smith and Thomas Smith, Nottingham—Cord and twine.
216. James Hankins, Bristol—Preventing incrustation in hoilers.
217. John Hunt, Birmingham—Chandeliers.
218. Marc A. F. Mennons, Paris—Engiucs.—A commnnication.
219. Marc A. F. Mennons, Paris—Looms —A commnnication.
220. Arthnr H. Chnrch, Great Portland Street—Preserving stone, &c.
221. Charles Culling, Norfolk—Fire-arms.
222. Samuel C. Lister and James Warburton, Manningham, near Bradford—Preparing cotton for spinning.
223. George H. Morgan and Edward Morgan, Grand Junction Terrace, Edgeware Road—Carriages.
224. George Chapman, Rutland Street, Leicester—Knitting frames.
225. Gustave J. N. de Ridder, Paris—Railway carriages
226. William E. Newton, Chancery Lane—Engines for pumping air or water—A commnnication.
227. William Irlam, Newton Heath, Manchester—Railway crossings and turntables.
228. Rudolph Bodmer and William Wilson, Newport, Monmouthshire—Artificial stones and fuel.

29*th January*, 1862.

229. John H. Brierley, Park Terrace, Halifax—Clasp or fastener for belts, bands, or straps.
230. Thomas Clayton and William Smith, Knowlwood, Lancashire—An improved flyer.
231. Francois D. de Bontteville, Fontaine-le-Bourg, France—Spinning.
232. Louis A. Pulve, Paris—Fire-proof iron chests and stroug hoxes.
233. John M'Kean and James Gabbott, Walmer Bridge Mills, uear Preston—Sizing yarn.
234 Thomas Meriton, Leadenhall Street—Boilers.
235. William Clark, Chancery Lane—Bleaching of textile materials for the manufacture of paper.—A communication.
236. James B. Harby, Leytonstone, Essex—Telegraph cables and wires.
237. Richard A. Brooman, Fleet Street—Puddling metals.—A communication.
238. Benjamin Foster and John Moore, Denholme, Yorkshire—Spinning.
239. William E Newton, Chancery Lane—Printing.—A commnnication.
240. William E. Newton, Chancery Lane—Journal boxes.—A communication.
241. George Bedson, Manchester—Wire fences.
242. Matthew Collier, Failsworth, Lancashire—Looms.

30*th January*, 1862.

243. George Phillips and George Phillips, jr., Holborn Hill—Distillation of alcohols or spirits.
244. Matthew Allen, Worship Street, Shoreditch—Construction of buildings.
245. Theophilns Gontard, Paris—Truss plates.
246. Edward A. Rippingille, Staple Hill, near Bristol—Engines and pumps.
247. James Firth, Heckmondwike, near Leeds—Finishing mohair cloth
248. Henry Robottom and Richard Underwood, Hoxton New Town—Watches and pocket chronometers.
249. William Davies, Old Bethnall Green Road—Cutting corks.
250. William Clark, Chancery Lane—Mechanical wreuches.—A communication.
251. Alexandre C. B. Malois, Paris—Boot and shoe heels.
252. Adolphus Lahousse, Brussels, Belgium—Wheels for railway vehicles.

31*st January*, 1862.

253. David Littlehales, Birmingham—Substitute for papier mache.
254. Horatio White, Hampstead Road, Middlesex—Collars.
255. John Silvester, West Bromwich, Staffordshire—Spring balances.
256. Francis Bagget, Birmingham, and Johu Sanger, Aston, uear Birmingham—Breech-loading small arms.
257. Hermann Schatten, Hesse Cassel—Gas meters.
258. John Dodge, Little Portland Street, Middlesex—Springs.
259. William Walton, Manchester, and Frederick Walton, Chiswick—Wire cards.
260. George Mehrtens, Charles Street, Hampstead Road—Ladies' stays.
261. John Hargreaves, Peckham, Surrey—Pipes or tubes.
262. Pierre Scheurweghs and Alexandre J. A H. de Boisserolle, Paris—Treating fatty and oily matters.
263. Charles Pontifex, Shoe Lane—Cooling or heating fluids or liquids.
264. Edward H. C. Monckton, Fineshade, Northamptonshire—Obtaining ammonia.
265. Thomas Stephens, Coventry, Warwickshire—Book markers.
266. James Gibbins, London Wall—Coating wood, metal, and other materials.
267. Alexander Forsyth, Glasgow—Frames and tablets.
268. Charles Veronique, Rue Thaitbout, France—Wrapper garment.

1*st February*. 1862.

269. William Smith, Bury, Lancashire—Bricks and tiles
270. Leon Fauvel, Paris—Indicating escapes in gas tubing.
271. Robert Burkhardt and Carl Doebler, Manchester—Eolian harps.
272. Jonathan Pendlebury, Dukinfield, Cheshire—Lubricating.
273. John Hill, Piccadilly, Middlesex—Portable chairs and vehicles for carrying sick or wounded.
274. Joseph Deprez, Anzin, France—Digging of mines.
275. Friedrich W. Daehne. Swansea, Glamorganshire—Zinc furnaces.
276. Thomas Cook, Coburg Road, Surrey—Punching and pressing metals.
277. John Harris, Store Street, Middlesex—Mattresses, squabs, pillows, &c.
278. Thomas Cook, Coburg Road, Surrey—Folding envelopes.
279. William Clark, Chancery Lane—Festooned edging.—A communication.

289. Francis Riesbeck and William Becker, Aldermanbury—Locks or fastenings.
291. Marc A. F. Mennons, Paris—Oleic acid.—A communication.

3d February, 1862.

282. Lawrence Hill, Port-Glasgow, Renfrewshire—Armour plating.
283. David Joy, Manchester—Forging metals.
284. Charles W. Lancaster, New Bond Street—Strengthening cast iron ordnance.
285. Charles Stevens, Charing Cross—Axletrees.—A communication.
286. James J. King, Wandsworth Road, Surrey—Fastenings of bedsteads.
287. William E Newton, Chancery Lane—Spinning.—A communication.
288. William Clark, Chancery Lane—Preserving and colouring wood—A communication.

4th February, 1862

289. Thomas M. Meakins, Chancery Lane—Projectile and explosive force.
290. George Manwaring, Southampton, Hants—Flushing apparatus.
291. Charles M. Roullier, Paris—Employing waste leatber.
292. Paul Gardilanne, Dax, France—Wire fencing.
293. James L. Norton, Belle Sauvage Yard, Ludgate Hill—Beating, stretching, and drying fabrics, and thrashing linseed.
294. Richard A. Brooman, Fleet Street—Soaps, and washing textile materials.—A communication.
295 John Greenwood, Portland Mills, Bradford—Combing wool.
296 Welburn W. Williamson, High Holborn, Middlesex—Drying clothes and fabrics.
297. James Webster, Birmingham—Gas fittings
298. William E. Newton, Chancery Lane—Iron and steel.—A communication.

5th February, 1862.

299. Daniel Gallafent, Stepney Causeway, Middlesex—Elastic vapours as a motive power.
300. William E. Taylor, Enfield, Lancashire—Carding engines.
301. John King, Chadshunt, Warwickshire—Lubricators.
302. Edward F. Smith and Thomas Swinnerton, Dudley, Worcestershire—Coke kilns.
303. John Browning, Minories—Aneroid barometers.
304. Henry Ashworth, Littleborough, Lancashire—Spinning.
305. Edward Harrison, Oldham, Lancashire—Substitute for gunpowder.
306. William Campion and Henry Johnson, Nottingham—Welts of hose, &c.
307. Jesse Lee, Church Gate, Leicester—Traction engines.
308. John B. Payne, Chard, Somersetshire—Hemp and flax.
309. Alfred V. Newton, Chancery Lane—Fire arms—A communication.
310. Charles Calow, Newton Heath, Manchester, and John W. Hirst, Manchester—Slide valves.
311. Adam C. Bamlett, Middleton Tyas, Yorkshire—Reaping machines.
312. James Pitkin, Clerkenwell—Aneroid barometers.
313 Robert Russell, Derby, Derbyshire—Stove grates and kitchen ranges.
314. Robert Shortedge, Brighton, Sussex—Ships of war with armour plates.
315. Peter H. Astley and Crosby Leighton, Stratford, Essex—Vessels, life boats, gun boats, or floating vessels.
316. Michael Henry, Fleet Street—Motive power.—A communication.
317 Edward C. Willis, Kensington, Middlesex—Treatment of wax.
318. Edward T. Bellhouse and William J. Dorning, Manchester—Hydrostatic presses.
319. John H Johnson, Lincoln's Inn Fields, Middlesex, and Buchanan Street, Glasgow—Pulp for paper.—A communication.
320. John Tonkin, Pool, Cornwall—Gunpowder.
321. John D. Dunnicliff, Nottingham—Lace or net bonnet fronts.

7th February, 1862.

322. Richard A. Brooman, Fleet Street—Stereoscopic albums.—A communication.
323. John Lloyd, Donnington, Shropshire—Buffers.
324. Peter Shaw, Edinburgh—Lamps.
325. Hugh A. Silver, Silvertown, Essex—Trays, cases, and bottles, in ebonite, vulcanite.
326. William E. Gedge, Wellington Street, Strand—Portable thrashing and winnowing machine—A communication.
327. Alexander M'Kenzie and Francis Panthel, Glasgow—Sewing machines.
328. William Clark, Chancery Lane—Preserving timber.—A communication.
329. Henry Macaulay and Alphonso F. Notley, Rotherham, Yorkshire—Fire guards.
330. William H. Bartholomew, Leeds—Barges or vessels.
331. Henry Brinsmead, Ipswich, Suffolk—Grain.

8th February, 1862.

332. John S. Woodhouse, Cheapside—Hooped skirts.
333. John Howie, Kilmarnock—Consumption of fuel in furnaces.
334. John A. Knight, Chancery Lane—Washing machines.—A communication.
335. Frederick Tolhausen, Paris—Wheel tyres.—A communication.
336 James Webster, Birmingham—Nails, bolts, spikes, and pins.
337. James Carrington, Kensington, Middlesex—Stalls and horse boxes.

10th February, 1862.

338. Marc A. F. Mennons, Paris—Phosphates of lime.—A communication.
339. Marc A. F. Mennons, Paris—Vapour baths.—A communication.
340. James Dickson, Tollington Road, Holloway—Voltaic electricity.
341. Richard Philp and John Philp, Lower John Street, Golden Square—Propellers.
342 John Busfield and Jonathan Eastwood, Bradford—Wool.
343. Bedford C. T. Pim, Commander in the Royal Navy, and George Fawcus, North Shields, Northumberlandshire—Armour plates.
344. Louis R. Bodmer, Thavies Inn, London—Hydraulic oil presses.
345. George Smith, North Brixton, Surrey—Shawls.
346. Joshua Danks, Waterloo Road, Surrey—Mats and rugs.
347. William Clark, Chancery Lane—Reflectors.—A communication.
348. Anthony Munck and Helge A. Myhre, Berners Street—Ships logs.
349. William Clark, Chancery Lane—Iron—A communication.

11th February, 1862.

350. William H. Weaver and Charles Gall, Bridgnorth, Salop—Agricultural machinery.
351. Thomas Fyfe, Leicester Square—Knapsacks.
352. Cornelius Bonell and William M Spiring, Wednesbury, Staffordshire—Rotary engine.
353. Ellis Sutton, Radcliffe, Lancashire—Cotton.
354. William Macnab, Greenock, Renfrewshire—Steam engines.
355. William Lyall, Amiens, France—Flax and hemp.
356. William Wood, Pontefract, Yorkshire—Pomfret or liquorice cakes.
357. John H Johnson, Lincoln's Inn Fields, Middlesex, and Buchanan Street, Glasgow—Smoothing irons.—A communication.
358. John Brinsmead, Charlotte Street—Pianofortes.
359. Richard Johnson, Manchester—Welded wires.
360. Gustav Lindemann, Manchester—Gas singeing or dressing yarns and fabrics.
361. James J. M'Comb, Pump Court, Temple, Middlesex—Fastening for bales or packages.
362. Francis J. Bolton, Bolton Row, Mayfair—Rifle and gun stoppers and oil bottles.
363. John Hetherington, Manchester—Cotton.

12th February, 1862.

364 Godfrey J. Aman, Liverpool—Transparent envelopes, bags, or wrappers.
365 Frederick Tolhausen, Paris—Vertical steam boilers.—A communication.
366. John Rohb, Aberdeen—Ventilating.
367. James Brickhill, Stepney Causeway—Cylinders and pistons.
368. Thomas Coltman, Leicester—Sewing machines
369. Andrew Hinshaw, Aldermanbury, Postern—Hooped skirts.—A communication.
370. Richard A. Brooman, Fleet Street—Ornamenting cast iron and other metals.—A communication.
371. John S. Joseph, Rhostyllan, Denbigh—Coke ovens.
372. Thomas Spencer, Liverpool—Propellers.
373. Alexander Samuelson, Cornhill—Ships and vessels.
374. Thomas Horsley, York—Fire arms.

13th February, 1862.

375. William E. Newton, Chancery Lane—Projectiles—A communication.
376. John S. Joseph, Rhostyllan, Denbigh—Retort oven.
377. John Peters, Ulverston, Lancashire—Steam engines.
378. Marc A. F. Mennons, Paris—Disinfection of animal excretions.—A communication.
379. William Williams, Bath, Somersetshire—Pianofortes.
380. William Hewitt, Birmingham—Rein holders.
381. Alfred C. Ebbutt, High Street, Croydon, Surrey—Chairs.
382. William H Brown, Camberwell, Surrey—Yards, booms, and gaffs.
383. Charles D. Abel, Southampton Buildings, Chancery Lane—Towing vessels.—A communication
384. Thomas Davison, Belfast, Ireland—Corroding of steam boilers.
385. Francis Falconer, Glasgow—Lamps.
386. Joseph F. Lawton and John Lawton, Vale Mill, Micklehurst, Cheshire—Flannel.
387. Richard Hornshy, Grantham, Lincoln—Thrashing, cleansing, and separating grain.
388. William D. Allen, Sheffield—Crushing ores.
389. George C. Burrows, Stoke Holy Cross, Norfolkshire—Lounges, seats, or apparatus for reclining on.
390. Edward E. Allen, Parliament Street, and John Stewart, Blackwall—Steam engines.
391. James E. M'Connell, Wolverton, Buckingham—Boilers and furnaces.
392. Edwin Green and James Newman, Birmingham—Buttons for fastening articles of dress.
393. James E. M'Connell, Wolverton, Buckingham—Railway breaks and warming railway carriages
394. Adolphus Jansen, Brussels, Belgium—Ball for fire arms.
395. William G. Valentin, Government School of Mines, Oxford Street—Coking coal.

14th February, 1862.

396. Samuel B. Whitfield, Birmingham—Bedsteads
397. Arthur J. Dodson, Clapham, Surrey—Coating or protecting ships' bottoms, railway sleepers, telegraphic wires, &c.
398. William Clark, Chancery Lane—Handles or knobs.—A communication.
399 Thomas D. M'Farlane, Glasgow—Sewing machines.
400. John H. Johnson, Lincoln's Inn Fields, Middlesex, and Buchanan Street, Glasgow—Propelling.—A communication.
401. William F. Smith and Arthur Coventry, Salford, Lancashire—Latbes.

15th February, 1862.

402. Henry Colwell, Davies Street—Improved truss.
403. Thomas Benison, Glasgow—Water closets.
404. John H. Johnson, Lincoln's Inn Fields, Middlesex, and Buchanan Street, Glasgow—Time keepers.—A communication.
405. William Avery, Birmingham—Screws, pins, rivets, and nails.
406. George H. Law, Rochester Road, Camden New Town—Boilers.
407. Joseph Wall and Thomas Dodd, Liverpool—Flow of fluids.
408. Cornelius Turner and Jack Shaw, Leeds, Yorkshire—Felted fabrics.
409. Thomas Horsley, Coney Street, Yorkshire—Cartridges.
410. John Cooke, Willington, Durham—Marine propulsion.
411. David D. Kyle, Victoria Street, Westminster—Signalling in railway trains.
412. Richard Bunting, Sheffield, Yorkshire—Bolsters and scales.
413. John Chatterton, Highbury, and Willoughby Smith, Dalston, Middlesex—Telegraph cables.
414. Robert Bell, Westland Row, Dublin—Treating fabrics.
415. Arthur H. Harrison, Park Place, Highbury—Under-garment.
416. John Green, Newton, Worcestershire—Signalling.
417. Jonathan Russell, Camberwell, Surrey—Raising vessels.

17th February, 1862.

418. Francis W. Gerish, East Road, City Road—Pumps.
419. Hugh Crawford, James Crawford, Robert Crawford, and Robert Templeton, Beith, Ayrshire—Looms.
420. John Hodgkinson and Daniel Greenhalgh, Bolton, Lancashire—Combing fibrous materials.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 28th January, to 4th March, 1862.

Jan.	28,	4437	W. J. Miers, Lamb's Conduit-passage—"Machine for cutting ovals"
,,	29,	4438	J. F Bland, 76th Regiment—"Register folio"
Feb.	10,	4439	C. Bell and J Pratt, Kettering—"Diamond Tile."
,,	15,	4440	Z. Shrimpton, Redditch—"Office pin."
,,	18,	4441	Powell & Sons, Bristol—"Jar."
,,	19,	4442	A. J. Rix, Cheapside—"Scarf."
,,	22,	4443	Kennan & Sons, Dublin—"Tilt gear."
,,	26,	4444	J. K Turner, Sheffield—"Spectacles"
Mar.	1,	4445	T. Pemherton & Sons, Birmingham—"Window catch."
,,	3,	4446	Roberts & Sons, Sheffield—"Office knife."
,,	,,	4447	A. Somerville, Birmingham—"Pattern card."
,,	4,	4448	J. Wheeler and C. Tighe, Poultry—"Collar and cravat."
,,	,,	4449	J. Garland, Birmingham—"Weighing Machines."
,,	,,	4450	C. S. Windover, Huntingdon—"Tessatempora."

THE PRACTICAL MECHANIC'S JOURNAL RECORD OF THE EXHIBITION OF 1862.

OUR covers for this month announce the particulars and the arrangements which we have entered into for the production, during the ensuing nine months, in immediate connection with *The Practical Mechanic's Journal*, of a work under the above title, in which, we trust, we shall succeed in giving a more complete and exact account of the International Exhibition of 1862, as respects all those subjects treated of from time to time in this *Journal*, than has heretofore been produced with reference to any previous Industrial Exhibition.

A staff of scientific contributors has been secured, whose names we present. The high reputation which belongs to every one of these gentlemen—acting in concert with our Editor-in-Chief—guarantees the character of the information which we hope to present. Amongst them are men whose names are illustrious wherever knowledge has penetrated, by the original discoveries with which they have enlarged science, and given fresh fulcra to human power; engineers, the fullest present type of the practical man, whose works have conferred benefits upon mankind, and upon themselves fame; mechanicians with names well known in connection with our highways of movement over land and sea; mining and military engineers, chemists, physicians, architects, artists, photographers, geologists, mineralogists, manufacturers, eminent in their respective spheres, are to be found within this band of intelligence, theoretical and practical.

Names equally celebrated, men probably fully as competent, on former occasions, have devoted their powers to the cataloguing and describing the objects of past Exhibitions—most notably that of 1851. The illustrated catalogue of that memorable exposition remains to this day a work of reference, creditable to its authors, and suited to the occasion. Yet, admitting its merits, its abiding value, the necessity of describing *everything* that was exhibited, smothered in a plethora of material, all chance of careful, exact, and discriminative criticism and comparison, upon the part of the official reporters of 1851. Unfortunately, too, a certain laudatory tone became, one knows not how, the mode—to point out defects fearlessly, to compare merits fairly and fully, was not "bon ton." The result is that he who now endeavours to extract from the great catalogue of 1851 the means of fairly deciding for himself what were the relative values, merits, importances, of many competing objects, will be disappointed in coming to a conclusion, and often find himself lost in generalities.

To unofficial descriptions, this same sort of objection applies. Those who write for all sorts and conditions of men, must write to the level of the information these already possess, and to the average wants for knowledge of the great masses, or rather to their wants for novelty and amusement. Great, therefore, as undoubtedly was the merit of the successive articles, descriptive of the Exhibition of 1851, that appeared in the *Times*, the *Daily News*, and other journals, they were—as the like for the coming one of 1862 must also be—for those who read for pastime rather than for information—for the multitude, not men of science and of manufacture.

For the special information of the professional classes, nothing was provided beyond what the already established journals could command in the way of increased matter, directed in each of them as far as possible into the special current of the all-absorbing Exhibition. But no scientific or technical journal can possibly, within the limits of its space and price, divert from its fixed and legitimate objects, and hourly growing crop of ordinary subjects, enough of energy, and page room—much less can it arrange a competent system of observation, (for the procuring information), and of collection and colligation, to bring the facts into a form digestible to the expert reader, and perform all this as parts, or rather as an excrescence upon its periodical duties.

One *Journal* alone early saw all this in its right light, and, as regarded its own special class—the world of Fine Art—arranged the means of giving its readers all the information they could desire. The *Art Journal* devised for the first time the plan of a work affiliated to itself, but yet distinct, giving an account of all that was most worthy of note in fine art, or art manufacture in 1851; and admirably, as respects illustrations, did it carry out its design.

In a large degree we declare ourselves indebted to this leading thought of the *Art Journal* for what we have now taken in hand. What the *Art Journal* account of the Exhibition of 1851 (and we hope for a like account of that about to be inaugurated) did for the Beautiful, we hope to accomplish for the True in science and art. its concrete. We shall not trespass upon our graceful contributor's walk. Fine art proper, in which the Exhibition of this year will so much abound—that is to say, picture painting or drawing, and sculpture wrought by hand—will not engage us at all. We leave it in the good hands we have already found it in. But no other part of the vast whole will be held outside our domain.

The catalogue of subjects and authors given in our announcement (the paradigm of our matter, as we may call it,) indicates, though very briefly, to what we shall address ourselves chiefly. It embraces all the main elements of material power—national or personal—viewed from the concrete and instrumental side. Within these great heads of natural products—agriculture and ship-building—architectural constructions, engineering structures, and machines.

Manufactures and their instruments that change the forms of products—chemical arts that modify or evolve their hidden properties. The instrument that science devises, that sense may know, and weigh, and measure—and so minister to the throned reason that discovers, and so to say, creates—within these heads many things will be referred to or described that at present admit of no other reference but that by classification.

Each larger subject will be introduced by our authors, with somewhat of an essay, with what our neighbours call considerations general, brief, but proportionate to the importance of each respectively, in which, noteworthy particulars in the historic epochs and efficient causes of improvement; or the contrary, the just apportionment of individual claims to original discovery, or improvement. The estimate of the proper place and relative importance that the subject holds in the great scheme of human progress; the directions in which to look for probable improvements, and the anticipations that the past may warrant an enlightened mind forming of a remoter future, will be elements. Thus, in each of our departments, we hope to present far more than a mere catalogue of even what is best and most important in the coming Exhibition, and we do not undertake to notice ought else.

We hope that each of our readers will feel that he has had a commentary tending to reduce to greater order his own personal experiences at the Exhibition, and evoking by contact of himself with the thoughts of men mature and exact in theory and knowledge of practice whatever is most capable of benefiting or enlarging his own career in whatever branch of useful employment.

Our aims are thus, we admit, high: we know the great difficulties of even approaching their fulfilment. We shall however do our best, as we are certain will all those men whose bright names it is our honour to have in this task associated with us.

ON SUBMARINE EXPLOSIVE SHELLS AS AN ARM FOR THE DESTRUCTION OF ARMOUR-PLATED SHIPS.

By Captain John Harvey, R.N., *Assoc. I. N. Archts.*

The armament of ships of war, at this period, consists of heavy cannon with their equipments; but the arm, to which attention is being directed, is very much less weighty than cannon, and altogether so different, that in designing vessels for such arm, the arm itself should be first understood, so that the form of vessel best suited to its service may be defined.

First, then, it is proposed to explain the construction and other details of the arm in question—designated the submarine explosive shell—and its application in the sinking of vessels at sea, so that we may the better understand what description of vessel, as to form and construction, may be deemed the most efficient in the employment of an arm that, apparently, will induce a great change in naval warfare, and naval affairs, involving not only tactics and strategy in battle upon the seas, but also naval architecture and naval establishments.

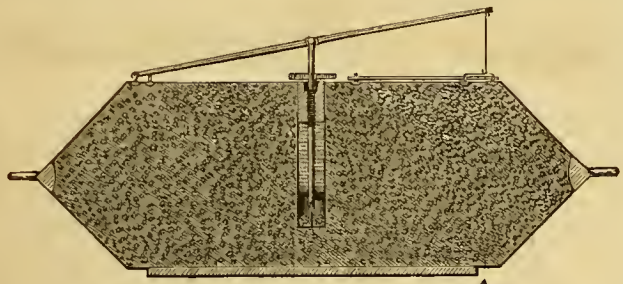
The submarine explosive shell may, at no distant period, prove, in naval warfare, the most destructive arm that has hitherto been employed; for although the essays, with engines of a like nature, by the Americans in the war of 1812, and by the Russians of late, were failures, it would be unwise to rest satisfied that cannon only are to be depended upon in naval combat, as the capabilities of the submarine explosive shell admit of being brought to a state of perfection, both in design and application, not yet generally understood, and properly appreciated.

In the present state of steam navigation, such engines can, under ordinary conditions, be more efficaciously employed than cannon. Steam vessels, constructed sufficiently shot-proof and buoyant, of the greatest practicable speed, armed with the shells in question, can choose their opportunity and mode of attack.

Under such circumstances, it is apprehended they would prove more than a match for the largest ships of war now afloat, formidable as they may be in ordnance of large calibre and length of range.

Submarine explosive shells admit of a variety of forms; the one now shown in sectional elevation and plan in figs. 1 and 2 respectively, has the advantage of being simple in construction, free from complication, and of easy application in combat. The form is that of

Fig 1.



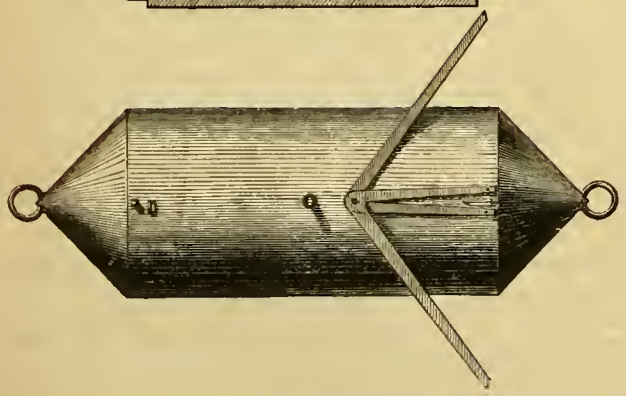


Fig. 2.

a cylindrical body, with two conical ends, head and stern; the material is zinc. Before the parts are put together, a circular plug of pewter, 2¼ inches long, and 1½ inch diameter, with its tube of zinc of about 8 inches length, closed at the bottom, and fitted with a pin of 3 inches length, and ¼ inch diameter, (designated the exploding pin), is soldered on to the in and upper side of the cylindrical body. Through the plug of pewter is drilled a circular hole about ⅝ inch diameter, to allow of a bolt, denominated the exploding bolt, being worked water-tight; the bolt is about 9 inches long, ½ inch diameter; there are also two loops soldered on the cylindrical body, one at the stern end to receive the lines or wires, by which the three levers are connected, the upper with the two side crank levers; and to this loop the line of the buoy (presently described) is made fast; the other loop is at the head or fore end, through which the safety key (presently described) is withdrawn. There is, besides, a hook at the fore end, to which is hooked the upper lever, also a bolt towards the stern end, an axis, upon which the crank levers work. To the stern conical end, there is a ring to receive the tow line; there is also a hole drilled through the solder, which is intentionally about 1 inch thick within, for the purpose of charging the shell; when this is charged, the hole should be tightly corked, and further secured by pitch. To the head conical end, there is a ring, as in the stern, to receive the tow line.

The three parts of the shell so fitted are soldered together; the shell is then, when painted, in a state to be charged when required.

The exploding bolt (the dimensions of which have already been stated) has a crutch at the head to receive the upper lever when put into gear; and in the lower end of the exploding bolt there is a cavity to receive a small glass bulb containing a small quantity of sulphuric acid, around which is put about ten grains weight of an explosive powder, composed of chlorate of potassa three parts (by weight), one part of sulphur powdered, and one part of refined sugar powdered—the three ingredients to be well blended; the explosive powder, so compounded, should be secured in the cavity of the exploding bolt, by tying over it a thin calico or such like material. To the exploding bolt is fitted a safety key, which is forelocked by a piece of twine; and to avoid accident the safety key is secured by it in the exploding bolt, and should, in *that* state, be stored. The use of the safety key is to prevent the exploding bolt, when inserted into the shell, being forced down beyond the desired position of about 1½ inch from the point of the exploding pin, for the explosion of the shell is accomplished by the exploding bolt being forced down by the action of the upper lever on the exploding bolt, the lower end of which being pressed down upon the exploding pin, explosion instantly ensues by the crushing of the glass bulb, and so setting free the sulphuric acid surrounded by the compound described. It may be here remarked that pads of bibulous paper are placed in the zinc tube around the exploding bolt to absorb any moisture that might arise from the bolt not fitting closely in the plug of pewter which supplies the place of a stuffing box; the bolt is served with twine to retain the grease which is applied to render it water-tight; the bolt may be adjusted by twine service to work with any amount of pressure desired, that is to say, about thirty pounds. There is a cavity in the pewter plug, ½ inch deep, into which, after the exploding bolt has been inserted, should be pressed a compound of becs' wax and tallow; the greater the pressure of the water, the closer will the compound be forced around the bolt, and so prevent leaking

The parts of the exploding apparatus, consisting of exploding bolt, three levers, upper and two crank or side levers, are not fitted to the shell when it is stored, but are put into gear when the shell is about to be launched overboard for action, presently to be described.

The dimensions of the shell are—cylindrical body, 24 inches long, 12 inches diameter, the two conical ends, each 6 inches long; the whole length, therefore, 3 feet. Its displacement in sea water, 118 lbs; its weight uncharged, 25 lbs; its capacity will allow of a charge of about 100 lbs. large-grained cannon powder; a charge which, in the absence of experiment or trial, is thought sufficient, when exploded about twenty feet below the surface of the water, and in *hugging* contact with the bottom of any vessel—a ship of the line for instance—to bilge her to an extent as to insure her sinking. The shell, when charged, and with its exploding apparatus fitted, will weigh 125 lbs; there must, therefore, be a buoy of about 30 lbs. displacement to suspend the shell at any desired depth below the surface of the water; the buoy line is made fast to the ring at the stern end, and to the loop, at the stern end of the shell.

It may be advisable not to have shells of larger dimensions than the one shown; for it is of a convenient size to handle and to store. If, upon trial, it should be found that 100 lbs of common gunpowder is not sufficient to bilge a ship of the stoutest scantling, it would be better to have recourse to an agent more violent in its explosion than common gunpowder, rather than increase the weight or volume of charge. One hundred pounds of powder, composed partly of the nitrate of potassa, and partly of the chlorate of potassa, would, it is thought, be sufficiently energetic, and at the same time safe to store.

Under some circumstances, it may, however, be necessary to use shells of large dimensions; shells of a capacity to contain ten hundred weight of powder.

A powder, compounded by Mr John Horsley (already mentioned), appears to be admirably suited to the purpose. It is very much more violently explosive, though less dangerous in manipulation than common gunpowder; it is free from the danger of explosion by friction, but explodes at a lower temperature than common gunpowder.

The capacities of shells of similar form are as the cubes of their

dimensions. A shell, therefore, of 4 feet length will contain 237 lbs. of powder; a shell of 5 feet length will contain 463 lbs of powder.

$3^3 : 100 :: 4^3 : 237$

27) 6400 (237
54

100
81

190
189

1

$3^3 : 100 :: 5^3 : 463$

27) 12500 (463
108

170
162

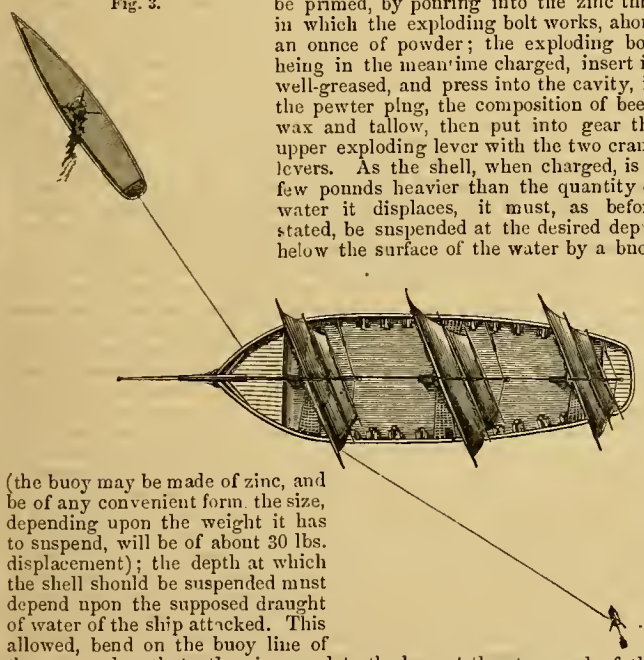
80
81

—

Having described the shell, its application may now be explained; and with a view to simplicity, the explanation will be confined to a single steamer, the attacking vessel, and adapted to the service of the arm in question; and a single ship the object of attack, presuming the attacking steamer can out-speed the ship attacked.

Suppose, then, the object of attack to be a ship under sail on the starboard tack to windward, and nearly within gun-shot distance. See fig. 3, which is a bird's eye view of the ship and attacking steamer. A shell is hoisted or handed up from below, and placed upon its launch on deck, close to the stern port; it should then be primed, by pouring into the zinc tube in which the exploding bolt works, about an ounce of powder; the exploding bolt being in the meantime charged, insert it, well-greased, and press into the cavity, in the pewter plug, the composition of bees' wax and tallow, then put into gear the upper exploding lever with the two crank levers. As the shell, when charged, is a few pounds heavier than the quantity of water it displaces, it must, as before stated, be suspended at the desired depth below the surface of the water by a buoy

Fig. 3.



(the buoy may be made of zinc, and be of any convenient form, the size, depending upon the weight it has to suspend, will be of about 30 lbs. displacement); the depth at which the shell should be suspended must depend upon the supposed draught of water of the ship attacked. This allowed, bend on the buoy line of the proper length to the ring, and to the loop at the stern end of the shell; launch the buoy overboard; the tow line, of about 150 fathoms length, and of suitable dimension and strength, should now be bent to the shell, and in such manner as to cause it to diverge to starboard; (it should be stated that the tow line is worked on a reel below deck) the fore lock of the safety key may also now be cut away, and the shell launched overboard, and veered astern about 30 yards.

The tow line may be made of hemp or coir. It would be well to be supplied with tow lines, or span lines, of each material. The shell may be towed by a wire rope or chain; by experiments only can the best means be ascertained.

The tow line should be devoid of twist; or, if laid up, as in ordinary rope, the tow line should be fitted with a swivel near to the shell.

It may be remarked that the shell can be easily launched, by a very simple contrivance, from the stern port. Upon the steamer getting within gun shot distance, the safety key should be withdrawn, and the shell veered astern about 150 yards, the steamer shaping her course so as to cross about sixty yards a-head; the ship, continuing her course, takes hold of the tow line by her cut-water or fore-body; the shell, by the progress of the steamer and the ship, is brought into *hugging* contact with the bottom of the ship; so soon as the shell is in such contact, the arm of the starboard crank lever is pressed in towards the stern of the shell, the exploding bolt forced down upon the exploding pin, crushing the glass bulb of sulphuric acid, which, set free, instantly explodes the shell, and so bilging the ship to an extent to insure her sinking. If, upon closing with the ship, it should be deemed advisable to bring the tow line under her keel, instead of across her cut-water or fore body; it may be accomplished by suddenly dipping the tow line which can be quickly weighted for the purpose. In such case, the shell would be *directly* exploded by the *upper* lever being pressed down, in coming into contact with the ship's bottom.

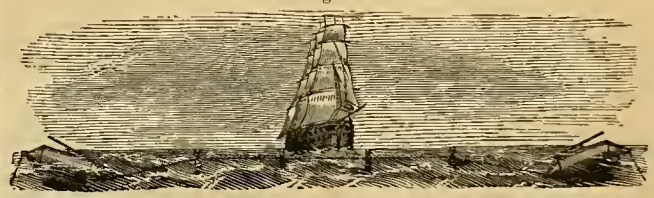
In attacking a steamer propelled by screw, it would be advisable to render her unmanageable by blowing away her propeller and rudder; this can be done by letting out a good length of tow line, so that when it is brought under, or into contact with her bottom, the shell would be drawn under her run by the progress of the attacking steamer. But the probability would be, that the propeller of the steamer attacked would lay hold of the tow line of the shell, and so wind it up as to bring it into contact with the propeller where it would instantly explode.

When proceeding to attack a vessel, three shells should be launched; one to diverge to starboard, one to diverge to port, and one to be directly astern; this arrangement may be effected by the adjustment of the tow line of each shell. The tow line in each case can, if desired, be brought under the keel of the vessel attacked, by a weight so fitted as to take down, at any instant, the tow line to the depth required. The reason of having a shell to diverge to starboard, and another to port, is to provide for the necessity of passing a-head or astern, or on either side of the vessel attacked, so that, in any such case of uncertainty, a shell will be brought into *hugging* contact, and in that position be exploded.

The shell, upon being towed, has a tendency to rise to the surface of the water, but being suspended by a line from its stern end, and the tow line being bent in the manner shown, the two combine to depress the head of the shell; under such condition, the shell, when towed at the rate it is likely to be, will keep at the desired depth below the surface of the water.

Many methods may be adopted for applying the shells; to explain each method would be tedious; the one selected admits of easy explanation. It may, however, be remarked that if the attacking vessel cannot take advantage of the darkness of the night, or a fog in daylight, and not being adapted to the service, the shells may be turned adrift, across the enemy's course, in pairs; held together by a buoyant span line, connecting them by their heads; a drag line being bent to the stern end of one or both of the shells, so as to keep the span line upon the stretch; a ship, in her progress, taking hold of the span line, by its being brought across her fore-body or cut-water, would bring one or both shells under her bottom, or alongside, some feet below the surface of the water; they would instantly explode upon being brought into *hugging* contact. Fig. 4 is a sectional elevation illustrative of this mode of procedure, showing the two shells and their span line, and the ship as in the act of breasting it.

Fig. 4.



In concluding this part of the paper, it should be stated that steamers in squadrons would act with greater advantage than singly; and they would, so acting together, be enabled to attack with the least risk; and, in the event of being disabled, could, if necessary, be abandoned by the aid of another steamer running alongside, and so rescuing the crew of the disabled steamer. A dark night and tempestuous weather are in favour of the attacking shell vessels; and these conditions are especially advantageous when attacking large, long, unwieldy vessels; and the greater the number of them together, the more easily can they be disabled or destroyed.

Shells, stationed defensively, allow of a variety of schemes, so as to render a naval attack extremely hazardous, if not wholly impracticable; this, however, is a problem for military engineers.

In conclusion, the purport of this paper is to show that in the present state of steam navigation and naval architecture, that vessels of comparatively small size and cost, but adapted to the service of, and armed with submarine explosive shells, can, in conflict upon the ocean, easily destroy, or render unseaworthy, vessels how large soever they may be, and armed with any cannon and projectiles at present known. Hence the necessity of being prepared with vessels suited to the change in naval warfare, which, sooner or later, will be adopted by all maritime states, by reason of its economy and destructiveness.

THE ANNEALING TEMPERATURES OF METALS AND CRYSTALLIZATION PRODUCED BY VIBRATION.

III.

In the second portion of this paper, (part for February, 1862) we have pointed out with sufficient examples the state of hopeless confusion in which the notions of our so-called "practical men" remain to the present time, in all that refers to the crystalline aggregation of metals, and the circumstauces assumed to modify it; and we have given a number of instances of metallic hodies, subjected for years to countless millions of vibrations, in proof of the fallacy of the popular opinion that vibration, *per se*, if long continued, and without any qualification as to range or extent, has any power to alter the internal arrangement of metals, or to make them brittle, or reduce their ultimate cohesion, and make them untrustworthy in use. So late as since our last part of this paper was printed, "The Times," in one of its articles upon the Hartley colliery beam, gives currency to just the old and average misty trash on the subject, and bases its objections to the beam having been of *cast* iron in place of wrought, upon a supposed "well-known fact," that the former becomes gradually brittle in use, owing to vibration, as though, if such were true for cast iron, it must not also be true, *pro tanto*, for wrought iron. The importance of endeavouring to promulgate some clear and true notions on this subject amongst civil and mechanical engineers, and ultimately amongst the public at large, has in no wise diminished.

We therefore propose here to describe as completely as our limits admit—

1st, The molecular constitution of metallic bodies as being crystalline.

2d, The circumstances that determine the arrangement of the crystals in metallic masses in the ordinary process of working them, more especially in iron in its several states.

3d, The circumstances and their limitations that are capable of modifying the crystalline arrangement (and with these, of course, the physical properties, such as cohesion, toughness, etc.,) of metallic masses in use, i.e., exposed to various strains, hlows, vibrations, etc., etc.

We must take the subject up at its heginning. The general facts that we shall refer to, are true of all metals, indeed of all crystallizable materials whatever; but our applications will chiefly have reference to iron in its three states, of cast irou, wrought iron, and steel.

Let this be premised and understood· *All simple metals are crystallized bodies, and are always crystallized*, and do not appear capable of existing in any other than a crystalline form. To speak, therefore, of a metal gradually *becoming* crystallized, etc, is nonsense. The crystalline arrangement may be *altered*, whether gradually or rapidly; it may become developed, and evident to the eye-sight, etc., in various ways, hercafter to be referred to; but a simple metal can exist only as a crystallized body. It is *perhaps* a fact that a few singular *alloys*, of which speculum metal is an example, possess a vitreous structure, breaking with a glassy conchoidal fracture, and being in the class of colloid bodies, according to Graham; hut it is probahle that this is only a masked and modified form of crystallization after all, for crystallization, i.e., *aggregation, under the influence of symmetric force, must* he the *fundamental* law of all matter. However, this state does not apply to any simple (unalloyed) metal, and does uot affect what is now before us.

Metals, as crystallized bodies, possess two combined properties, belonging to their integrant crystals, that distinguish them from all other crystallizable solids. The crystals of metals are all, more or less, flexible and malleable. Flexible crystals are found in various bodies not metallic, as, for example, in the hair-like crystals of amianthus, of zeolites, selenite, mica, etc., hut flexihility, with malleahility, is almost peculiar to metallic crystals. Thus, for example, the greater portion found of gold dust and nuggets consists of insolated crystals of gold, more or less ground away and distorted by attrition. From South America, perfect crystals are abundantly brought, beautiful little round looking dodecahedral heads, whose surface of bright polished crystalline planes, prove the whole to he a crystallized solid.

If we lay one of these upon an anvil, we can flatten it by the blow of a hammer into a thin shining spangle, or we may beat it still further out into gold leaves that would cover more than a foot square. Aqua regia and a lens will yet reveal to us that the spangle has not lost its crystalline structure. The origiual form of the crystal has been distorted, but the metal is still crystallized. Is there any reason can be assigned, that the gold leaf (merely a further extension of the distortion of form) is not also crystalline in structure? Let the flat spangle be now laid upon a piece of charcoal, and fused with the blow-pipe, or the gold-leaf—pinched and rolled up into a little heap, be so fused—when cooled again, the original crystalline formed bead will be found reproduced, if not in the identical form, at least in one crystallometrically derivable from it.

Thus, the crystalline condition is never lost while the metal remains solid, but it may be lost to the senses, and ohliterated or modified to any extent in virtue of this combination of properties peculiar to metals, viz., the crystallization and malleableness of their integrant molecules.

It is this curious combination of crystallizability and malleability that gives rise to many of the most remarkable and important working properties of our ordinary metals, and, as we shall see, notably of iron.

The discovery of the general law upon which the arrangement of the integrant crystals of metallic masses depend is comparatively recent, and is due to Mr Robert Mallet, who first enunciated it in his paper on the physical conditions involved in the construction of artillery, read before the Royal Irish Academy in June, 1855. Although, as yet to a great degree unnoticed amongst those engaged in practice, it has been recognised and admitted by physicists and metallurgists, and is of the highest universality and application in every branch of metallic working, when once thoroughly grasped, and its important modifyiug powers ou metallic masses become understood.

In the above memoir, its author has shown that from one simple law all the varied conditions of integrant form, in cast and wrought iron, etc., are readily deduced, and that this law is the key to the solution of all such questions as relate to *changes in crystalline arrangement* effecting metallic masses subsequently to their original aggregation. In fact, like all true light when once discovered in nature, this law of crystalline arrangement clears away all the fogs and darkness of the suppositious effects of vibrations (referred to in our former parts), and points out distinctly what are the limits and the nature of those effects that vibrations or strains of any sort can effect.

From this single principle flows the explanation of the arrangement of crystals in castings of iron—the causes of their weak places interiorly; the true nature of the so-called "fibre" in wrought iron, and of its development, or of that of hroad plates of crystals. The effects of working in different ways, or by various methods, rolling, hammering, etc., can all be predicted, as well as all subsequent changes that can be induced in the crystalline or "fibrous" (so-called) states of wrought iron, by strains or hlows, or other such means, at common temperatures. We shall have to he very brief in comparison with the extent of the subject and its importance; and we refer to the original memoir of Mr Mallet, in the transactions of the Royal Irish Academy for 1855, for its full examination. We venture to say that its study will be found to repay (in the mental mastery it is capable of conferring) every one concerned in the large application of iron to structural or dynamic purposes.

Mr Mallet thus expresses his fundamental law regulating the molecular constitution of crystalline bodies generally, metallic or not. "*The law of the molecular aggregation of crystalline solids is, that when their particles consolidate under the influence of heat in motion, their crystals arrange and group themselves with their principal axes in lines perpendicular to the cooling or heating surfaces of the solid; that is, in the lines of direction of the heat wave in motion, which is the direction of least pressure within the mass.*" He defines the "principal axis" to be "*the longest axis of symmetry of the integrant crystal*," and he shows that this axis, though not ascertainably the *optic axis* in metallic crystals, is yet intimately related to it, and that it is in metallic crystals the axis of greatest elasticity of Fresnel; and he points out, hy numerous experimental examples, that, as an invariable matter of fact, "In all metallic masses that have passed from fusion to the solid state this longest axis of symmetry is found coincident with the direction in which the heat wave has passed out from the mass when cooling, or into when heating (if the crystalline arrangement has been determined or altered by the latter mode), that is to say, that such axes shall be found in directions perpendicular to the bounding planes or surfaces of the cooling mass, by which the heat wave has passed off."

But, as all bodies contract in cooling, and the reverse; and as a body passing from fusion to solidity cools fastest at the surface, internal straining forces of compression originate within the body whose directions are necessarily parallel to the bounding surfaces; but such compressions being a maximum in these directions are necessarily a minimum at right angles to the same, hence the directions of least pressure (due to these internal strains of contraction or expansion) are perpendicular to the bounding surfaces of the cooling body, and these are the directions in which the principal axes of the integrant crystals are found to be arranged after the body has become cold. Mr Mallet further points out that certain researches of Sir John Herschell indicate that the proximate cause of the phenomena is simply due to *pressure* within the mass—heat itself having (so far as inferable from these facts) no *specific* action in determining the crystalline arrangement, but being merely *the means* through or by which, internal and unequal pressures are produced in cooling or heating masses; and he also points out some highly interesting relations between his "principal axis" and that crystalline axis in which Senármont showed an unequal conducting power for heat as compared with the others: but into these we cannot now enter.

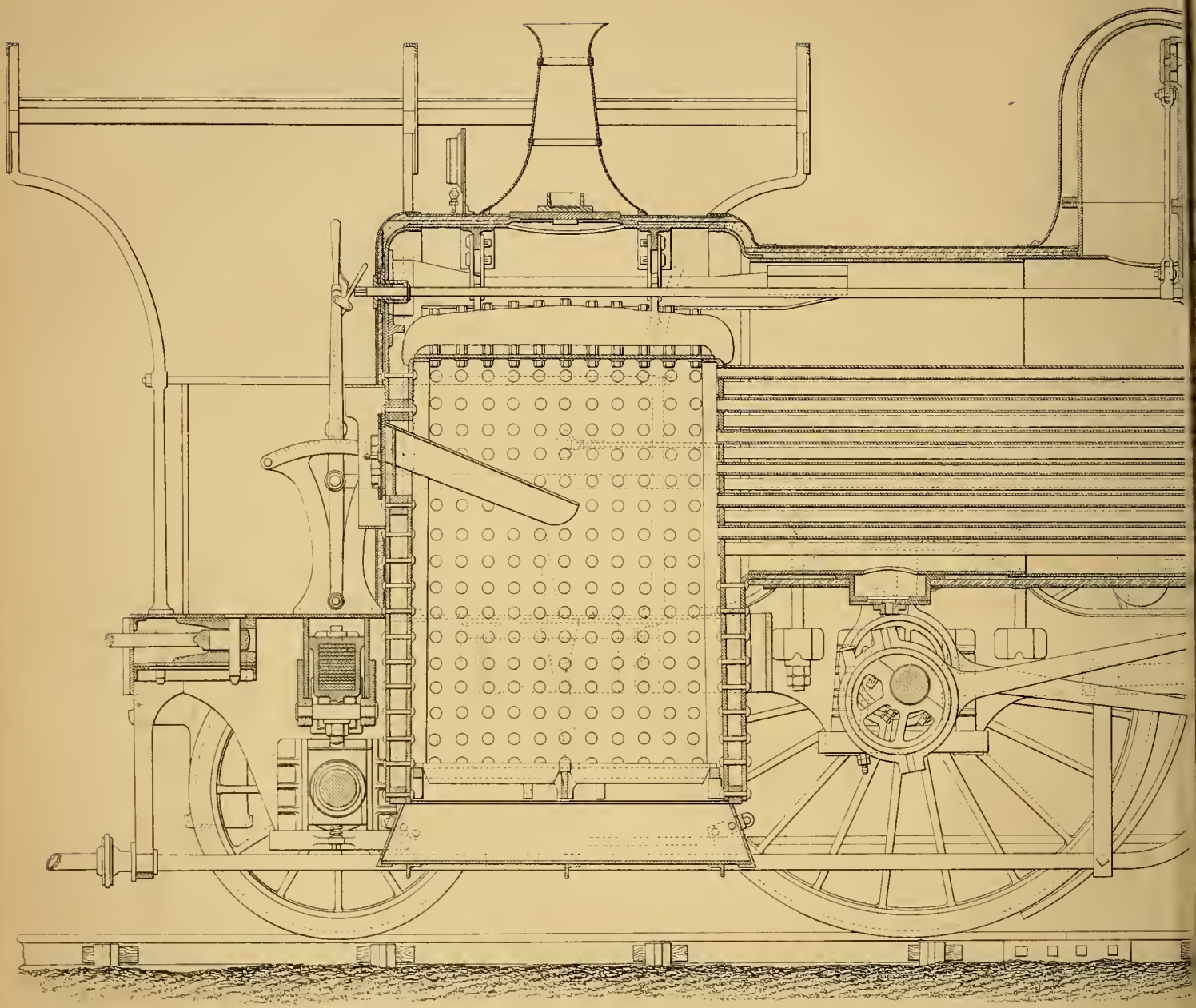
To name an example or two of the facts. If a roll of fused sulphur (as found in the shops) be examined, its cross fracture will show all the long axes of the crystals, arranged radially from the centre, i.e., perpendicular to the bounding surfaces of the cylinder. A

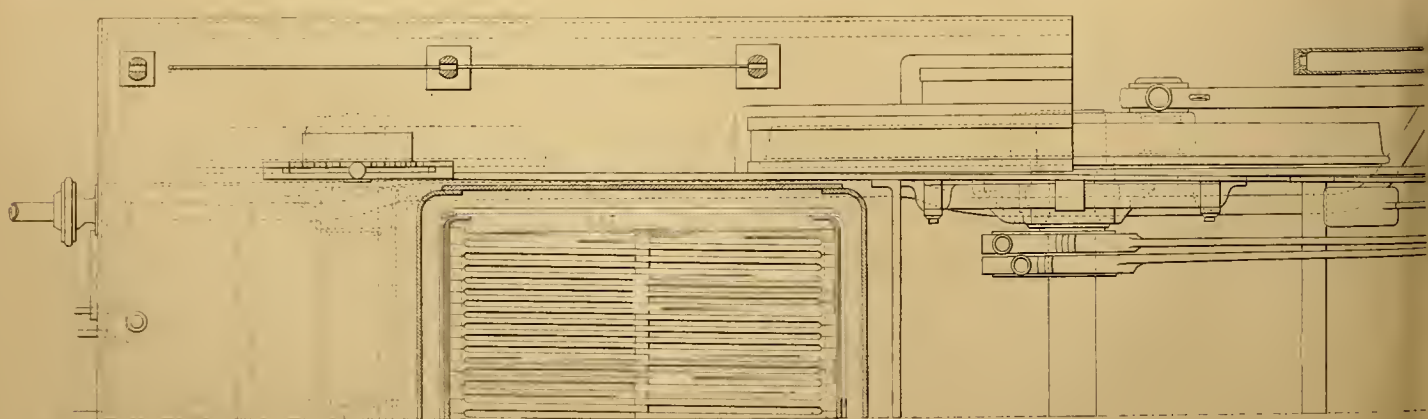
Plate 286.

LOCOMOTI

DESIGNED FOR THE

BY J. M. RE





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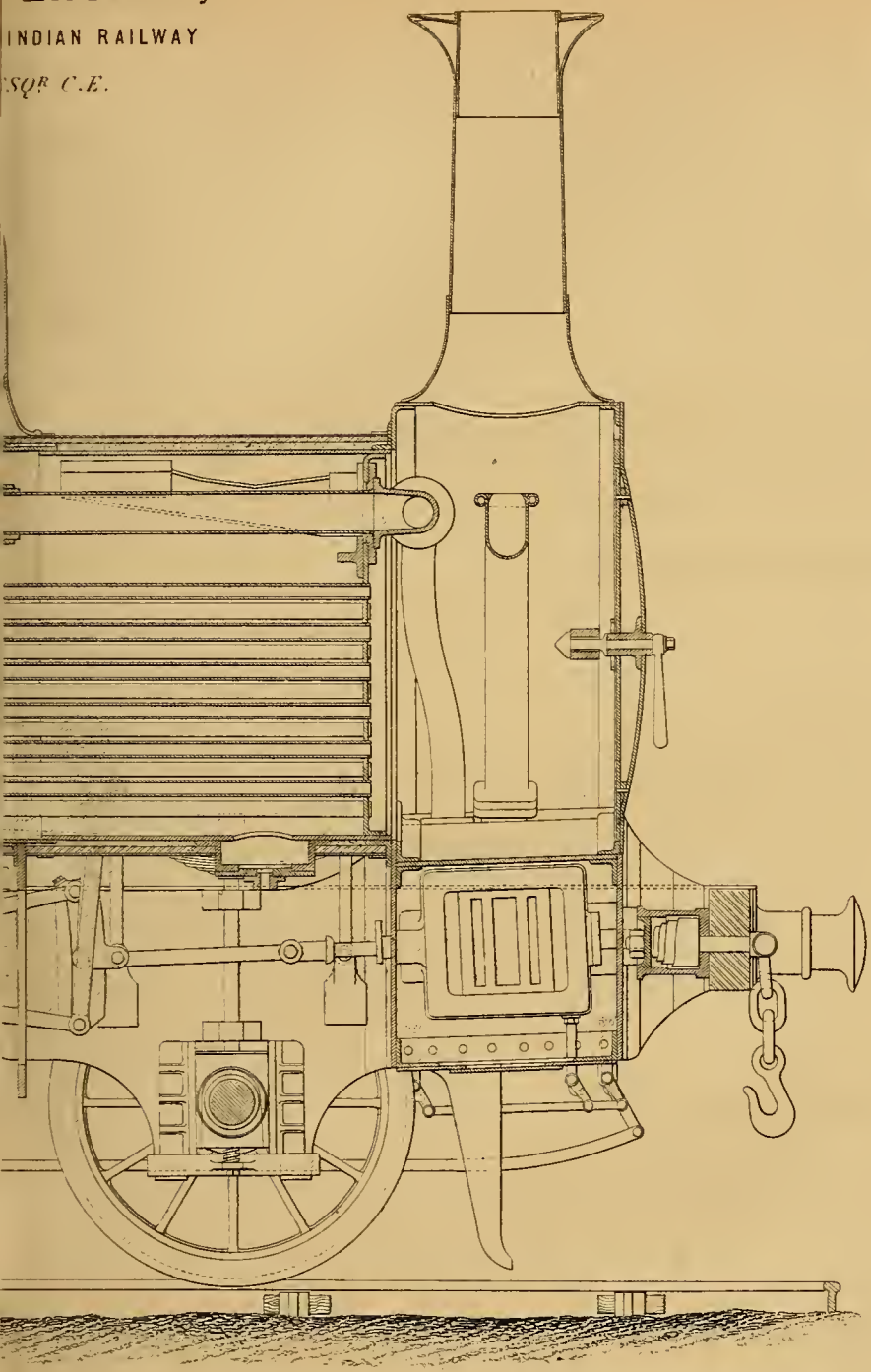
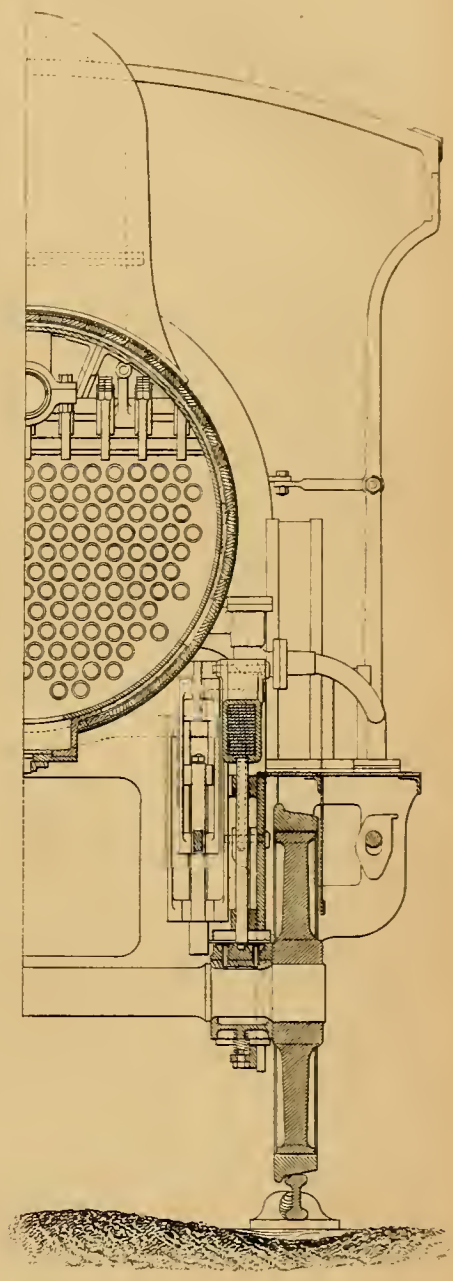
ENGINE,

INDIAN RAILWAY

SQR C.E.

1st MAY 1852
Second Series
Vol. VII.





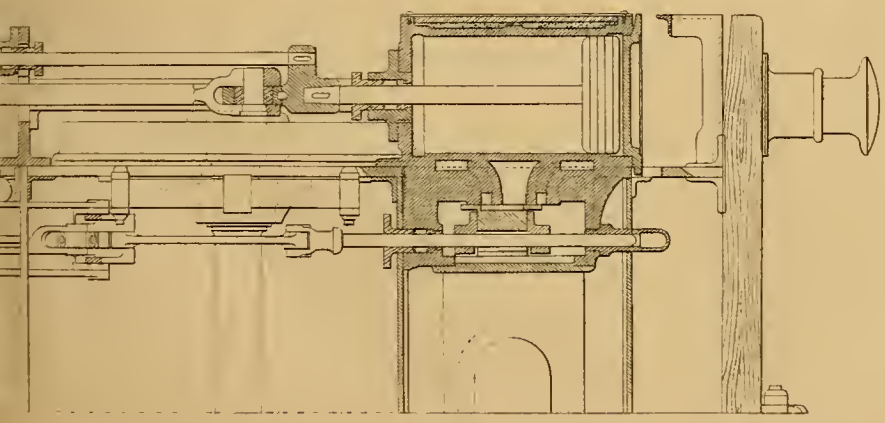


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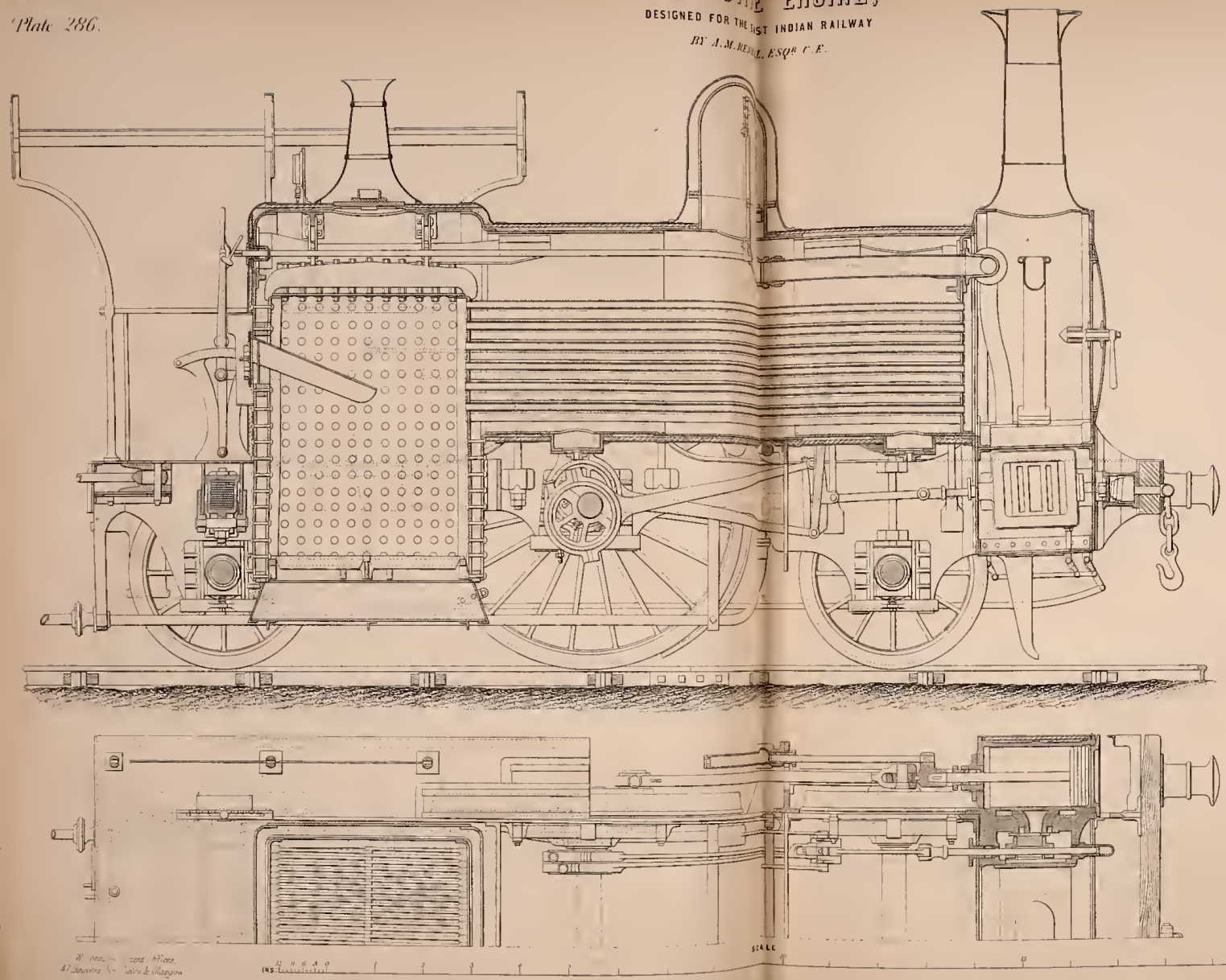
Plate 286.

LOCOMOTIVE ENGINE,

DESIGNED FOR THE EAST INDIAN RAILWAY

BY A. M. RENDEL, ESQ^R. C.E.

1st MAY, 1862
Second Series
Vol. VII



nearly square ingot of zinc or antimony likewise shows all its crystals perpendicular to the bounding planes, the cross fracture showing the long axes, abutting or interlacing along the diagonals, where they form those "planes of weakness" of which the author has made such important use in explaining the peculiar directions of fracture in which cast iron guns burst, and deduced the means of prevention as far as possible. Many other examples might be given, but these must suffice. Those given are of the case in which the crystalline arrangement is determined by the passage from the liquid (fused) state to the cold (solid) one. But like changes of crystalline arrangement, Mr Mallet has pointed out, are produced by the converse. If, for example, a cylinder of lead, of say four or five inches diameter, and about as long, be cast around a two feet long cylindrical bar of iron of say 1½ inch diameter, the lead when cold will not present any traces of internal crystallization; if now the projecting end of the iron bar be heated red hot, and time given until the heat conducted along the bar and from it passed into the interior parts of the lead cylinder around it, and thence transmitted outwards radially through the lead in all directions, shall have raised the temperature of the lead itself to within a few degrees of its melting point—say 550° Fahrenheit; if the lead now, or after it has become quite cold again, be struck a sharp blow with a hammer, the whole mass of the cylinder will be found to have assumed internally a crystalline structure—all the principal axes of the long, thin crystals radiating regularly outwards from the axis of the cylinder, or bar within it, to its external surface, and by a few blows the whole mass will separate and fall to pieces, as a metallic dust of elongated crystals.

The process of making "grain tin" by heating a large apparently homogeneous block of tin upon one face, is a like case. Again, "If a thick plate of rolled or malleable zinc, which is nearly homogeneous (visually) in structure, or if not, on fracture presents fibres and lamina, *in the plane of the sheet*, be laid down flat upon a cast iron plane, heated to within a few degrees of the melting point of zinc, it assumes very soon a well developed crystalline structure, and if now, or when become cold, it be broken, the crystals will be found having all their large plates (principal axes) cutting *perpendicularly through the plate from side to side;* in other words, the planes of internal structure, or crystalline axes, have been absolutely turned round through 180° in angular direction, without fusion, and merely by having powerful strains of unequal expansion induced within the mass, by a wave of heat parallel to its greater surfaces being passed into it.

Many other examples, even more striking to the man of science, may be adduced. The facts are general; they apply to all metals.

The first deduction made decides the law of molecular constitution of *cast iron*, and is as follows:—

Cast iron, as being a crystallizing body, obeys the general law in consolidating from its liquid state, so that it may be enunciated as a general fact that "*in all castings in iron, the planes (or axes) of crystallization tend to place and group themselves perpendicularly to the surfaces of external contour.*"

Because the crystals of cast iron (except in the case of spiegel eisen, or of ordinary "chilled castings," in which the phenomena are grandly developed) are always small, and are never very well pronounced, these directions are seldom, in ordinary castings, very apparent to the eye, but they are not the less real.

Mr Mallet has shown that their more or less complete development depends upon three conditions—

1st, Upon *the character of the cast iron* itself, mainly upon the amount of carbon it contains, and the state of its combination with the iron; the most graphitic, and the pure spiegel eisen sorts of cast iron develope largest crystals.

2d, Upon *the mass of the casting;* the largest crystals, from the largest mass, but not necessarily the most regular ones.

3d, *The rate of cooling*—the most regular development of crystals being produced by the slowest cooling.

The greatest development *possible* is produced by very large castings made in "chills," because here we have all the conditions best capable of the effects—rapid *surface* cooling—slow total refrigeration, by largeness of mass—and internal strains of contraction the most powerful. Many most important practical deductions have been made from these primary facts as to the methods and practices of iron founding and casting, by Mr Mallet, in his work on the construction of artillery.

LOCOMOTIVE FOR THE EAST INDIAN RAILWAY.

Specification of a Locomotive Engine, with 15-inch outside Cylinders and 22-inch Stroke; Leading and Trailing Wheels 3 feet 9 inches diameter; Driving Wheels 6 feet 6 inches diameter; Gauge 5 feet 6 inches. Designed by A. M. Rendel, C.E.

(*Illustrated by Plate* 286.)

The barrel of the boiler is to be cylindrical, 10 feet 7 inches long from the outside of the front end of the fire-box casing to the inside of the front tube plate, 4 feet diameter inside, at the smallest place, and made of plates, 7-16 inch thick, single riveted. The rivet holes are to be 13-16 inch diameter, and the rivets are to thoroughly fill the holes; the pitch or distance between rivets is to be 1⅞ inches, and the lap of plates 2¼ inches. Great care must be taken that all the plates are brought well together before any rivets are put in, and that all the holes perfectly correspond with each other, no drifting of the holes being allowed. The heads of the rivets must be properly set up, and all joints perfectly caulked on both sides, care being taken that in so doing the plates are not injured.

Each end of the boiler is to have two wrought-iron gusset stays, 5 inches wide, and 1 inch thick, riveted with double angle irons; one transvers T iron girder is also to be fixed at each end.

The tube plate at the smoke-box end is to be ⅝ inch thick, and flanged inside the barrel of the boiler, the outside of the flange being turned to fit the boiler accurately. The holes in the front and back tube plates, which correspond with each other, are to be drilled parallel and square to standard gauges, the back plate holes 2¼ inches diameter, and the front plate holes 2 5-16 inches diameter. All the holes are to be spaced with perfect accuracy at equal distances from centre to centre. The boiler is to have one washing-out plug in the bottom of the front tube-plate. Upon the barrel of the boiler is to be riveted a wrought-iron ring, 2 feet diameter inside, 8 inches deep in the middle, and ⅝ inch thick. On the top of this ring is to be placed a dome, 2 feet diameter inside, and 7-16 inch thick. The meeting flanges of the ring and dome must be turned up one inch thick, and a steam-tight joint made with the introduction of a layer of very thin red lead. The hole cut in the barrel of the boiler is to be oval and smaller than the base of the dome.

Two rings (similar to those placed on the top of the boiler) 1 foot diameter inside, and ⅝ inch thick, with covers ¾ inch thick, having blow-off cocks bolted to them, are to be placed under the barrel. The flanges and covers to be faced as in the case of the dome.

In the inside of the barrel of the boiler is to be placed a regulator and copper conducting pipe. The pipe to be No. 6 wire gauge thick, and to be bolted to smoke-box tube-plate and to the regulator, as shown in the drawing; and outside the front tube-plate, and in connection with the steam-pipe, is to be placed a joint flange and breech steam-pipe. The breech steam-pipe is to be of cast-iron, and the joint flange of wrought iron securely brazed to the copper pipe. A regulator rod, handle, guides and stuffing box, are to be provided, and a brass delivery clack-box with clack-cage and hall complete, is to be placed on each side of the boiler.

The tubes are to be solid brass drawn tubes of such manufacture as the Engineer shall approve. They are 157 in number, and are to be accurately 2¼ inches diameter outside for the whole length. They are to be drawn tapered, No. 9 wire gauge thick at the fire-box end, and No. 12 at the smoke-box end. They are to be fixed with ferrules at both ends.

The ferrules must be made of the best steel, and turned so that they will go into the tube a tight driving fit; care must be taken that the ends of the tubes are not cracked or otherwise injured by improper drifting for the ferrules.

The front plate of the fire-box casing is to be 9-16 inch thick, flanged over and wrought to the shape shown in the drawing. No angle iron is required for making up the corners.

The crown, back and sides of the fire-box casing are to be made of four plates, ½ inch thick; the rivets and rivet holes are to be the same in all respects as before specified for the barrel of the boiler.

On the top of the fire-box casing is to be riveted a wrought-iron ring, to which is to be bolted a wrought-iron cover, forming the seating of a brass castiug which is to contain two safety valves. The rivet holes are to be ⅝ inch diameter and 2 inches pitch.

Four brass mud plugs and mud plug seats are to be placed, two on each side of the upper part of the fire-box casing, and a brass mud plug and seat is to be placed at each of the bottom corners of the fire-box casing. A blow-off cock, gauge-glass fittings, two gauge cocks, a scum and a warming cock, an ordinary whistle, a guard's whistle and a steam indicator (Bourdon's patent) are to be placed on the fire-box casiug, and all made and fixed as shown by drawings.

On each side of the fire-box casing is to be riveted a frame guide; all the sliding faces are to be planed.

An ash-pan and dampers are to be placed below the fire-box casing, with two moveable doors worked by handles from the foot-plates. The sides of the ash-pan are to be 5 16 inch thick, and the bottom ⅜ inch thick.

The inside of the fire-box is to be made of the best copper, to be obtained from parties to be approved of by the engineer to the company; the dimensions and construction are to be in exact accordance with the drawings. The flanging of these plates is to be executed by the makers of the engines.

The tube-plate is to be ⅝ inch thick at the tubes and tapered regularly below to ½ inch at the bottom edge. The sides and crown-plates are to be ½ inch thick all over. The back-plate is to be ¾ inch thick for 8 inches all round the fire-door, tapering thence regularly to ½ inch at

the edges. The whole are to be well riveted together, the rivet holes being 13-16 inch diameter and 1¾ inches pitch.

The fire-box casing and fire-box are to be stayed together on every side with best copper stays, ⅞ inch diameter, screwed with 14 threads per inch, and placed as shown in the drawing. The plates are to be tapped and the stays to he tightly screwed in and well riveted over at the ends. Nine roof stays are to he plaeed on the top of the fire-box, formed of single bars of the best assorted scrap hammered iron, 6 inches deep by 1¼ inches thick in the centre, stepped down to 4½ inches by 1¼ inches at the ends. Each is to be secured to the roof of the fire-box by 11 bolts, ⅞ inch in diameter, with a solid collar, 1½ inches long, under the stay, and screwed through the roof with a nut at each end of the bolt.

The greatest care must be taken to make the roof stays bed well on the bend of the end plates of the fire-box. No mere setting with the hammer will be allowed, but the hammer and chisel must be used in fitting these stays into their respective places, and speeial attention must be paid to this point. Eight vertical sling stays are to be plaeed as shown in the drawing and fastened to the inside of the fire-box casing and to the roof stays; they are to be put into tbeir places hot, so that a proper hold may he obtained of the roof stay. Two lead plugs are to be fixed in the roof of the fire box, one near the right-haud corner in front, and the other near the left-hand corner at the baek.

The fire-door is to be made with a regulating air slide, and a moveable wrought-iron shoot projecting inwards, and provided with a suitable handle, is to be fitted against it. A steam jet is also to be provided in the funnel, having a perforated ring round the orifice of the blast pipe, and worked by a handle from the foot plate.

The top, front, sides and door of the smoke-box are to he made of ¼ inch plate. The steam chest box below is to have the top and bottom and front plates ⅜ inch thiek, the back plates ½ inch thick. The lower angle iron frame is to be 3½ by 5½ inches and ⅝ inch thick. The bottom plate is to have a man-hole in it, which is to be provided with a cover ¼ inch thick.

The ch mney is to he made of good smooth plate, with jump joint and countersunk rivets down the back; the whole to be perfectly free from hammer marks, and the bottom carefully fitted to the top of the smoke-box, so that a perfect joint can readily he made by a little red lead.

The fire-bars and their frame are to be so carefully made, that they may not only change readily with eaeh other, but with other engines also.

The whole of the wrought-iron used in the work specified above, whether in plates, angle irons, rivets or bolts and nuts, unless it has been otherwise distinctly specified, is to be of Lowmoor, Bowling, or S. T. Cooper and Co.'s best manufacture, except the ash-pan, the fire-door, the smoke-box casing, the steam-chest box, the chimney, the fire-bar frame and fire-bars which may be of any best Yorkshire or Staffordshire make of which the company's engineer may approve.

The wheels are to be forged out of the best wrought-iron, with solid arms and bosses. They are to be 6 in number, viz., four 3 feet 9 inches diameter over tread of tyre, and two 6 feet 6 inches. Great care must be taken that the bosses, arms and rim are all perfectly solid. They must be turned and bored and have keyways cut exactly to template, so that they may be exactly alike. The axles are to be perfectly parallel inside the wheel bosses, and each wheel must be put on its respective axle by screws or hydraulic power, with a pressure of not less than 70 tons for the large wheels, and 60 tons for the small: the rim must be correctly turned to a gauge, to receive the tyre, and the whole wheel trimmed up so that the surfaces and lines may be all fair and true. The crank pins are to be of wrought-iron case-hardened. The right hand crank is to he set to lead.

The tyres are to be of the best Lowmoor, Bowling, or S. T. Cooper and Co.'s iron, 5¼ inches wide and 2¼ inches thick at the centre of the tread when finished: to be carefully bored before shrinkiug on the wheels, and accurately turned afterwards, so that all the leading and trailing wheels may be preciscly the same diameter, and that the driving wheels may all be of the exact diameter assigned to them. The tyres are to be secured by coned bolts, accurately fitted to fill the holes in the tyres, and of the same description of iron as the tyre.

The axles must all be of the very best fagoted wrought iron, either of Lowmoor, Bowling, or S. T. Cooper & Co.'s best manufacture, free from imperfections of every kind; and must be accurately turned throughout their entire length to the correct dimensions.

The exceutrics are to he in two pieces each; the larger piece is to be made of strong and hard cast iron, the smaller piece of wrought iron. The excentrics are to he fastened on the shaft by means of set bolts. The excentric strap liners are to be of the best gun-metal, the rods and straps are to have the oil cups forged on.

The wrought iron work is to be all composed of the best Lowmoor, Bowling, or S. T. Cooper and Co.'s iron, and of the very best finish; and each piece is to be well and properly case-hardened and recleaned up. All the pins which are shown of the same dimeusions must fit every part of the motion equally well. Care must also be taken that all the split pins are made to the dimensions shown.

The frames must be of some best Yorkshire or Staffordshire plate, to be approved by the company's engineer. Their plates are to be 1½ inches thiek in every part when finished to the form and to the dimensions given in the drawings. They must be planed over on the whole of the outer face where the cylinders are fitted; all the holes must be marked and drilled from one template, and rymered out to the exact size given; and each holt securing the cylinders, stays, &c., is to be turned to gauge, and fitted to its place so as to require being driven home.

The leading buffer plate is to be of the best East Indian teak, 5 inches thick and 13 inehes deep, and perfectly sound and free from defects, baeked by a plate of wrought iron ¼ inch thick. The trailing buffer plate is to be ½ ineh thick. All the iron used in them is to be of the same quality as the frame plates

When the frames and cylinders are all bolted and riveted together, and before the boilers and wheels and axles are put into their plaees, the correctness of all the dimensions, and the truth and accuracy of all the work, is to be carefully cheeked by diagonal as well as longitudinal and transverse measurement. The frames are to be strictly square and free from cross windings, and the hornplates square with the engine in all directions.

The feet and angle irons of every stay of every kind, where they bed upon the frame, are to be planed perfectly true and to the exact length required, so that they may fit correctly to their places, without setting or twisting of any kiud, and every hole must be rymered out in its place as specified for the frames. No liners or filling pieees of any kind will be allowed to make up imperfect work or dimensions.

Platforms are to run the whole length of the engine on either side, supported by braekets from the frame and angle irou round the edge, and are to be made of good iron chequered plate ¼ iuch thick.

The splashers are to be made of sheet iron, ⅛ inch thick, with good smooth and clean surfaces, and bolted to their places. The whole to be well riveted and finished in a workmanlike manner.

The pillars attached to the trailing buffer beam and foot plate are to be of good wrought iron. The hand-rail which goes round the boiler and smoke box, and its supporting pillars, are to be of brass, neatly polished and finished.

An awning framing is to be provided, and attached to the pillars of the hand-railing.

The leading and trailing axle-boxes and keeps are of the same dimensions; the driving axle-boxes and keeps differ slightly from them, having larger bearings. All are to be made of cast iron, with bearings of the best gun metal. The driving axle-boxes are to be provided witb adjusting wedges.

The bearings are to be well fitted to one-third of the circumference of the journals. No more space is to be allowed between the axle-boxes and rubbing pieces at front and back than just sufficient to allow each axle-box to slip readily and freely iuto its place.

The axle-blocks are to be of hard and strong cast-iron, planed over on both sides, and firmly fastened to the inside of the frame by means of bolts accurately turned and driven tightly home, and secured with nuts, and the bolt ends slightly riveted over.

The springs are to be of the very best spring steel, made from Swedish iron. Each spring is to be tested before being put in its place by being weighted until all the camber has been taken off and on the removal of the weight the spring must resume its original form. All the springs are to be made of the dimensions and to particulars shown on the respective drawings. The centre pins of the leading and driving springs are to be flat, and the boles for them not more tban ¼ inch wide. The whole of the wrought-iron work for tbe springs is to be of the best Yorkshire or Staffordshire hammered iron.

The cylinders are to be 15 inches diameter when finished, and made to accommodate a stroke of 22 inches.

They are to be of the strongest close grained cold-blast cast iron, as hard as can be got up, and perfectly free from honeycomb or other defeet. They must be truly bored out, the ends heing slightly bell mouthed. All the joint surfaces are to be planed and turned or scraped to the true surface, so that a perfect joiut may be made with a thin layer of red lead laid on with a brush. The steam-chest cover is to be of wrought-iron, and all the nuts inside the smoke-box to be of gun-metal. All glands and packing rings to be of gun metal.

The pistons are to be cast of a good strong close-grained iron in two pieces, which are to be riveted together over the piston rod end. The packing is to consist of two rings of gun metal, tongued at the joints, and steam ways are to be drilled through the pistons to the baek of the rings.

The piston, connecting and coupling rods are to be of the best Lowmoor, Bowling or S. T. Cooper & Co.'s iron, or the best scrap forgings of the same material, as may be directed by the company's engineer. The connecting rods are to be bright all over. The bearings in them are to be of gun metal, perfectly sound and free from honeycomb.

The slide valves are to be of gun metal.

The slide bars are to be of the best cast steel or wrought iron ease-

hardened, as the engineer may direct, and are to be polished all over.

The slide blocks are to be of cast iron, free from honeycomb, and all other defects, and chilled on the wearing faces.

The pumps are to be of the best gun metal, with a ram of the best Lowmoor, Bowling or S. T. Cooper & Co 's iron. All the joints must be made without packing of any kind; the two metal surfaces are to be in all cases brought into perfect contact, and made thoroughly steam-tight by means of a cone that stands up from one flange, and for which a recess is cut in the other.

The feed pipes are to be of copper, 3-16 inch thick; they are to be all drawn pipe, and so perfectly uniform in length and set that any pipe may fit its respective place on any engine equally well.

All the clacks are to be perfectly alike, so as to permit of changing in any manner without difficulty or inconvenience. Care must be taken that the pipes are so set that the flanges of all joints come fairly into their places without any spring upon the pipes.

There are two steam-pipes in the smoke-box; they are to be made of copperplate, No. 6 wire gauge thick, and hard soldered together on the inside. The flanges are to have scraped surfaces, and nothing more than a little thin red lead put on with a brush will be allowed at the joints.

The exhaust pipes are to be of copper, No. 8 wire gauge, made in all respects the same as the steam pipes. The breech-pipe is also to be of copper.

The boiler and fire-box, above the level of the frame, are to be covered with a double thickness of felt, and with well-seasoned and dry pine, in strips not more than 2½ inches in width, by about ⅝ inch thick, tongued together by hoop iron, ⅝ inch wide, and the whole well and neatly covered by charcoal sheet iron, No. 18 wire gauge, and well secured by iron bands.

The drag and coupling chains and pins are to be made of the best Lowmoor, Bowling or S. T. Cooper & Co.'s iron. A small volute draw-spring is also to be fitted in front of the engine with a shackle and eye.

The buffers are to be composed of volute springs with solid wrought-iron heads, plungers and boxes. The buffer heads are to be alternately flat and convex.

The bolts and nuts are to be all strictly to gauges, and must be screwed to Whitworth's standard threads, except where otherwise distinctly specified.

All the working parts are to be furnished with perfect means of lubricating.

All the gun-metal used is to be composed entirely of one part of tin to seven parts of copper by weight; all to be of new metal, and no other composition to be employed.

The cylinders are to be furnished with cocks at each end, worked by a handle at the foot-plate; oil cups are to be formed on the excentric straps, and the oil cups on the links, levers, &c., are to be worked out of the solid wrought iron. The pumps are to be furnished with pet cocks and gear, the handle of which is to be easily accessible from the foot-plate. The glass water gauge is to be so placed that the lowest visible part of the glass is three inches above the highest part of the crown of the inside fire-box.

The spring balances of the safety valves are to be carefully adjusted to indicate the pressure correctly, and a solid collar is to be forged upon each spindle to prevent the balance being screwed down beyond 120 lbs. pressure per inch.

There is to be a small chain secured to the fire-hole door for opening and shutting it. A lampholder must be fixed at the front end of the engine. Copper-pipes are to be fixed to the fire-box casing for carrying away the water from the gauge and scum cocks. The covers of the dome and man-hole, and the back and front corner plates of the fire-box are to be of brass polished.

The boiler and fire-box casing must have two coats of thick red lead previously to being cleaded. The wooden cleading is to have one coat of lead colour before the iron covering plates are put on. The cleading upon both boiler and fire-box, the frames, splashers, handrail, plates, wheels and all the necessary parts of the engine are then to have two good coats of lead colour, no filling up of any kind being required.

Each engine is to be provided with a tool-box, a complete set of screw keys, one large and one small monkey wrench, one heavy and one hand hammer, one lead and one copper hammer, and all the necessary fire-irons, six chisels, one head lamp with 9-inch diameter of face, and one gauge lamp, and one large size traversing screw-jack.

All the working parts of the machinery are to be well case-hardened, to ensure this they must be in the furnace at least 48 hours.

The contractor is to furnish with every 10 engines one complete set of duplicate gearing, including one pair of wheels 6-feet 6-inches diameter, with crank pins, axles and excentrics, two pairs of 3-feet 9 inch wheels with axles, one set of springs with links and pillars complete, one pair of cylinders fitted up complete and ready for fixing, with valves and valve spindles, covers, glands, &c., four pistons with rods, one set of slide bars with cross heads and slide blocks; two pumps right and left hand, with rams, clacks, boiler clack-boxes, and flanged ends ready for brazing on to the feed pipes, &c., &c.; one pair of connecting rods complete, and four excentric rods, with straps, expansion links, reversing links, pendulums, valve rods, lifting links, weigh shaft and carriages, &c., reversing quadrant, handle and rod, forming one complete set of gearing throughout for one engine, with two extra pistons; also one complete set of fire-bars with frame; the whole fitted up and finished ready for use, and exact duplicates of the corresponding parts in the engines.

TENDERS.

The frames are to be of wrought iron throughout.

The outside frame is to be 18 feet 7⅜ inches long, 10 inches deep in the straight part and ⅜ths of an inch thick.

The axle-box forks are to be in one piece with the main frame. They are to be well tied together by tie bars, 2½ inches deep and ⅝ inch thick, made to clip and fit well upon the fork ends.

There are to be three cross stretchers, one at front end and one midway between each pair of wheels; they are to be 10 inches deep and ⅝ inch thick, well secured to the outside frames by double-angle irons.

The outside frames are to be 7 feet from centre to centre; there are to be also two inside frames, 16 feet 9¼ inches long, 10 inches deep and ⅜ inch thick, placed 4 feet 6 inches apart from centre to centre; the inside frames must be well secured to the cross stretchers by double-angle irons.

The hind end is to be furnished with wrought iron buffer plate, 8 feet 4 inches long, 13 inches deep, and 1⅛ inch thick, mounted with two buffers of the same kind as specified for the engine.

A draw spring, 3 feet 6 inches long from centre to centre of eye, 3½ inches broad and 5 inches thick, is to be fixed inside the end plate, and provided with links, spring-hoop and drawing apparatus complete.

The foot-plate end is to be made double from the first cross stretcher by ½-inch plates placed seven inches apart, well secured to the outside frames and end cross stretcher by angle irons; and is to be provided with buffer springs, buffer rods, with guides and draw-plates and pins.

A 2½ inch angle iron is to be riveted outside the outer frames to carry a platform from end to end, of the same dimensions as the engine platform.

A break is to be provided with six hangers, one behind each wheel, to be acted upon simultaneously through the cross shaft in front, each two hangers acting upon the same pair of wheels shall be tied together by cross tie rods, and all the levers upon the front cross shaft are to be welded upon it.

The bearing springs are to be placed above the frames, and are to be 2 feet 6 inches long, 4 inches broad, and the 4 hind ones 4½ inches and the two front ones 4 inches deep.

The spring links are to clip the spring ends and be attached thereto by a pin, secured in its place by a flat split cotter. The lower end of the links is also to be attached and secured to the frame in the same manner. The spring pins must be double, one on each side the frame.

The tank is to be 6 feet 4 inches wide, and 3 feet 3 inches deep, curved in front down to the bottom, the sides being continued to the foot-plate to form the coke space; the whole is to be secured to the frames and cross stretchers by 2½-inch angle iron.

The tank plates are all to be of the best Staffordshire iron, the sides and ends 3-16 inch thick, and the breast and bottom plates 5-16 inch thick; the sides, the ends, and the top and bottom are to be properly stayed by cross longitudinal and vertical plate stays to each other.

There are to be three pairs of wheels 3 feet 9 inches in diameter in the centre of the tyre treads. The bodies and bosses are to be forged out of best iron.

The tyres are to be of the best Lowmoor, Bowling, or S. T. Cooper and Co.'s iron, and are to be when finished 5¼ inches broad and 2¼ inches thick in the centre of the tread. The rims must be turned and the tyres bored before the tyres are shrunk on.

The axles are to be of Lowmoor, Bowling, or S. T. Cooper and Co.'s iron. They are to be 7 feet long from centre to centre of journals, 5 inches diameter in the centre, 6⅝ inches behind the wheels, and 6½ inches diameter at the part that passes through the wheels, which is to be perfectly parallel, and the wheels are to be pressed on with a force of not less than 40 tons. The journals are to be 8 inches long and 4½ inches diameter turned to templates and case hardened.

The axle-boxes and their keeps are to be of cast-iron provided with gun-metal bearings.

The coupling pipes between the engine and tender are to be of gun-metal, and are to have a spherical joint at each end, and a union joint coupling in the centre.

The contractor is to furnish one tail lamp for each tender of the same dimensions and construction as the engine head lamp, except that it must have a red instead of a white glass.

The contractor is to furnish with every 10 tenders one complete set of 3 feet 9-inch wheels and axles with axle-boxes, springs, spring links and

pillars completc; a pair of gun-metal coupling pipes and two feed valves, the whole of which are to he perfect duplicates of the relative parts of the tenders.

GENERAL CONDITIONS.

The entire contract is to bc executed in the most approved substantial and workmanlike manner, according to the direction and to the satisfaction of the company s engineer, who is to have power to inspect the manufactnre either personally or by deputy in all its branches and details in such manner as he may think fit, and to reject any work of which he may disapprove ou any ground whatever, and his decisiou on any points of dispute, or doubt which may arise in reference to the contract shall be final and binding on both parties. No advantage is to be taken of any accideutal omission of details or error in the drawiugs furnished or in this specification.

General drawings of the engine and tender and of all their principal parts will he provided by the compauy, but each contractor must make his own copies thereof and his owu workiug drawiugs, every detail of which must be signed by the company's engineer as approved by him before the work is commenced.

The contractor is not to assign or sublet any part of this contract nor allow any portion of it to be done except on his own premises without the express consent of the company in writing being first obtained.

Each engine is to be erected complete on the works of the maker and to he tried in steam in the presence of the company's engineer, or his deputy. The pressnre in the boilers is to be not less than 140 lbs. to the inch under steam, but the boilers are to be also tested by hydraulic pressure to 200 lhs. to the inch.

After the engines have been satisfactorily tested they are to he taken to pieces and carefully packed and protected in such manner as the engineer may consider best for transport to India.

The correct weight of each piece, package or case as delivered, is to be distinctly marked on it, and also such shipping marks as may he directed.

The cost of all cases, casks or other packages, and also of all such packing, protecting, marking, &c., is to he ineluded in the contract sum.

The eontractor will be held responsihle for any accident in loading or unloading the engines, either here or in India, which in the opinion of the engineer is attributable to the weights having been incorrectly marked upon the parts.

Parties tendering are to state the time in which they will be ready to deliver the first two engincs let to them, and the rate at which they will continue to deliver them.

In the event of the contractor failing to deliver the engincs at the time stated in the tender, the sum of £20 will be deducted from the contract price of each engine for each week which it may he overdue, as liquidated damages.

The engines and tenders arc to he delivered frec alongside in any dock or on any wharf or in any part of the stream in either of the Ports of London or Liverpool as the company shall direct.

No payment will be cousidered as legally due to the contractor until the completion of his contract; but advances of money on account will he made to hiu at such times as the engineer shall recommend, to the extent of not exceeding 90 per ccnt. of the value of the work delivered, deducting penalties, if any, the balance being retained without interest until the engineer shall have given his certificate of the satisfactory completion of the contract.

It is, however, to be expressly understood that such advances are in nowise to be considered as evidence of any particular quantity of work having been executed, or of the manner of its execution being satisfactory, or in any other way to relieve the contractor from the liabilities he may sustain under the terms of the contract.

But if at any time the progress of the contractor shall be so slow that in the opinion of the company's engineer he will not be ahle to complete the work at or about the time specified, the company are to be at liberty to declare the contract at an end, paying only for such work as has been actually delivered at the time, the contractor remaining liable for any loss or damage which the company may sustain by reason of his breach of contract.

Tenders, which may be made for either the whole or for any number of engines required, not less than 10, are to be in the subjoined form, which must not he detached from the specification.

The directors do not biud themselves to accept the lowest or any tender if they should consider it inexpedient to do so.

These engines are designed by Mr Rendel to burn the native Indian coal of the Burdwan collieries.

MORTICING AND DRILLING MACHINE FOR WORKING IN WOOD.

A powerful labour-saving machine for working heavy mortices and drilling large pieces of timber, hitherto only capable of being done by hand, has been recently introduced by Messrs S. Barton & Sons, of Derby, Machinists. This machine is morc particularly designed for the heavier class of carpenter's work, whether in hard or soft wood; and it makes very little difference in regard to the perfection of the work, whether the wood is wet, dry, coarse, crossgrained, or knotty. It is most economical, and saves much time and labour in the construction and putting together of such works as the frames of earts, waggons, trucks, and all kinds of railway and other earriages; also, for that of the timbers of roofs, the wooden frames of machines geuerally, whether for millwright work or agricultural implements.

Fig. 1 of the accompanying engravings is a side elevation of the machine; and fig. 2 is a front elevation of the same at right angles to

Fig. 1.

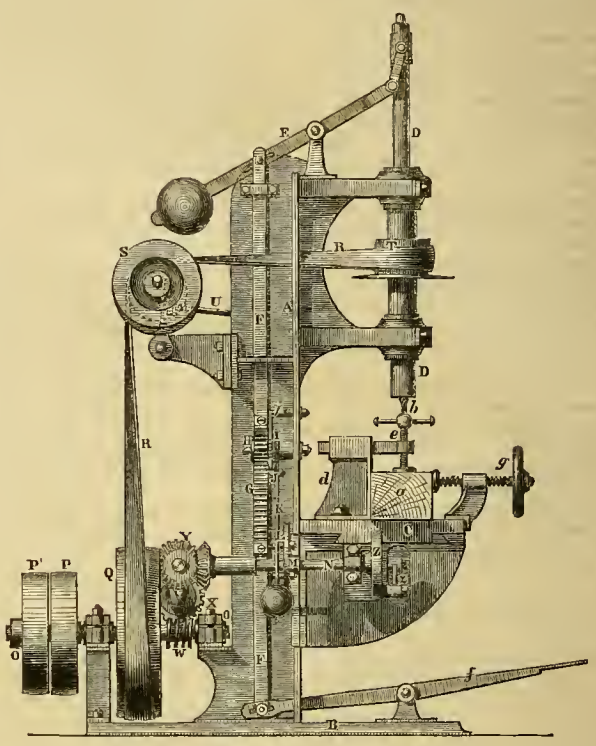
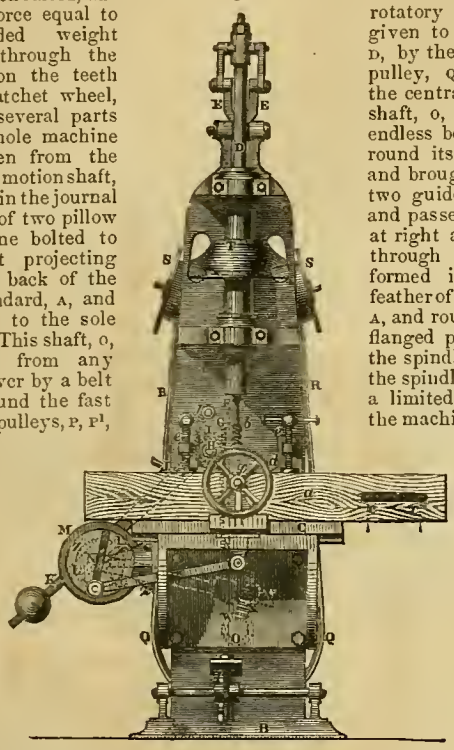


fig. 1. The main frame of the machine consists of a strong vertical standard, A, either bolted to or cast in one with the sole platc, B; to the front of the standard, A, near the lower part, is attached, by screw bolts, the fixed table which carries, in guides ou its upper surface, the sliding table, C, on which the piece of wood, *a*, to be morticed or bored is adjusted and fixed. In nearly a vertical lino with the ceutre of the table, C, the boring and morticing spindle, D, is carried in journal bearing, formed in two brackets projecting laterally from the upper front part of the staudard, A. This spindle is free to revolve, and, at the same time, slide vertically in these bearings, aud for this purpose it is attached near the top hy a swivel joint and two links to one end of a long actuating lever, E, centred in small brackets bolted to the top of the main standard, A. The lever, E, is counter-balanced by a weight attached to its other end, which being rather heavier than the weight of the spindle, D, always tends to bring it to its highest or normal positiou, as shown in fig. 1, when not otherwise actuated by its connecting rod, F. The vertical "feed" or motion of the spindle, D, is either given by the attendant through the tread lever, *f*, attached to the lower end of the connecting rod, F, or automatically by the machine itself through the toothed rack, G, attached to the ceutre of the connecting rod, F. Into this rack is geared a pinion, H, on the same boss with the ratchet wheel, I, turned by the pall or detent, J, carried on the actuating lever, K, by increments of one or more teeth, at each stroke, according as the two studs carrying the actuating cam tappet rollers, L, are fixed near to or far from the centre of the disc, M, which is keyed on the centre of the horizontal revolving shaft, N. This shaft, N, is carried in the bearings of brackets bolted to and projecting laterally from the side of the main staudard, A, and the fixed table, and the pinion, and ratchet wheels, H and I, rotate loosely on the same stud projecting from the standard, A, on which their actuating lever, K, is centred. As this lever, K, is loaded at its free end by a weight, it follows that every time the lever is raised by the tapets, L, twice for every turn of the shaft and disc, N and M, that it will turn the ratchet wheel and pinion, I and H, in a direction

to raise the rack and boring and morticing that which the lever, K, has been raised, and with a force equal to its loaded weight exerted through the pall, J, on the teeth of the ratchet wheel, I. The several parts of the whole machine are driven from the main first motion shaft, O, carried in the journal bearings of two pillow blocks, one bolted to a bracket projecting from the back of the main standard, A, and the other to the sole plate, B. This shaft, O, is driven from any prime mover by a belt passed round the fast and loose pulleys, P, P^1, conuecting rod, G, F, and so depress the spindle, D, through a space proportional to

Fig. 2.



carried on its outer end. A very quick rotatory motion is given to the spindle, D, by the large broad pulley, Q, keyed on the central part of the shaft, O, through the endless belt, R, passed round its under side, and brought up to the two guide pulleys, S, and passed over them at right angles to and through two holes formed in the front feather of the standard, A, and round the small flanged pulley, T, of the spindle, D. When the spindle, D, has only a limited traverse, or the machine is not constructed to work very deep mortices, then the pulley, T, may be keyed to the spindle itself, but when it is required for deep heavy mortices then the pnlley is keyed to a short hollow shaft, through which the spindle, D, slides up and down, having a groove and feather. Thus, while the inner spindle, D, is driven round along with the hollow spindle, and its pnlley, T, it is yet free to move vertically through the hollow one, which is retained in position between the two bearings of the spindle, D. The spindle of the two guide pulleys, S, is mounted on a small frame which oscillates on a joint formed in a bracket bolted to the back of the main standard, A, in such a manner, that by lengthening or shortening the bolt or stud, U, which is screwed into the small frame, and fixed at any desired length by a jam-nut, it will tighten the belt, R, by the head of the bolt, U, acting on the standard, A, and pushing over the small frame and guide pulleys, S. Motion is given to the feeding shaft, N, from the first motion shaft, O, through the intermediate angular shaft, V, and driveu at a slow speed through the screw and screw-wheel, W and X, at the end next the shaft, O, and at the other end next the shaft, N, by a small pair of bevel wheels, Y. On the other end of the shaft, N, is keyed a slotted crank or disc, Z, the crank-pin of which is attached by a connecting rod, *z*, to a snug formed on the under side of the sliding table, C, so that the table gets a reciprocatory motion equal to twice the length of the crank pin from the centre of the disc or crank, Z. In tbis way, within certain limits, any desired length of traverse can be given to the table, C, and the piece of wood secured to it, by fixing the crank piu at the proper point in the slot of the disc, Z. One edge of the slot being graduated to inches and parts so as to show at once where to fix the pin for any length of mortice which may be required for the time being. The leugth and shape of the mortice for the disposition of the parts, as delineated in the figures, is shown in the piece of wood, *a*, as turned on its side at *c*, in fig. 2, the distauce, *c-c*, being the whole throw of the crank or traverse of the table, C, in this instance. In proceeding to use the machine for morticing, the piece of wood, *a*, is laid on the sliding table, C, and against the face of the fence, *d;* and the feuce which is moveable on the top of the table, along with the piece of wood, is so placed that the centre of the mortice will be in the true vertical line with the centre or axis of the boring and morticing tool, *b*, (the table being previonsly placed in its normal or central position,; then the fence, *d*, is screwed fast to the table, and the piece of wood, *a*, fixed by the two vertical and the front horizontal screws, *e* and *g*, respectively. If the crank pin is now fixed in the slot of the disc, Z, so that its whole throw will be equal to the distance, *c-c*, of the mortice, which is required, as shown in fig. 2; then the machine is ready for starting. This is done by bringing the boring tool down to the wood with the foot lever, *f*, and drawing the belt of the prime mover by a lever, in the usual way, on to the fast pulley, P, of the first motion shaft, O, a quick revolving motion of the spindle, D, and its boring tool, *b*, is communicated by the belt, R, having at the same time a downward vertical "feed," which takes place by means of the two tappets, L, at the moment when the pin of the slotted crank, Z, carried by the revolving shaft, N, is at the dead centres, or end of its stroke iu both directions. Thus a new cnt downwards takes place at each end of the mortice, as the table at the same time, with the piece of wood on it, traverses to and fro; the machine will go on iu this way boring, and slotting (or morticing) at one and the same time, until it has pierced the piece of wood to the required depth, or quite through, when it is stopped by the attendant throwing the belt on to its slack pulley, P^1, or otherwise by taking the wheel, X, out of gearing with its screw, W, and removing the pall, *j*, out of the teeth of the ratchet wheel, I. The table will then cease to move, and the spindle and boring spindle and drill, D and *b*, will return to their normal position, clear of the wood by the counter-weight on the end of the lever, E, when the piece of wood may again be set and fixed as before for a uew mortice.

When the machine is to be used for boring or drilling only, the connecting rod, *z*, is disengaged from the pin of the crank, Z, or if not required to feed itself, the wheel, X, is taken out of gear with its screw, W, and the drill, *b*, fed down by the attendant through the tread-lever, *f*.

The improved cutting tool *b*, is so constructed that the wood shavings are thrown out as fast as produced, leaving the mortice quite clean and clear, while at the same time the tool is sufficiently strong that it is not liable to break in any kind of wood work. This machine is well worthy the attention of all those who are engaged in the construction of all kinds of heavy timber-work, as it mortices with a despatch and saving of labonr heretofore unknown; a mortice can be cut with it 12 inches in length, and depth, 3 inches wide, through a piece of stout English oak in forty seconds, ready for receiving the tenon, without requiring any paring or dressing with a chisel or other hand tool.

THE MERRIMAC AND THE MONITOR.

The following is from an officer of the *Cumberland:*—

"The *Cumberland* and the *Congress* were at auchor at some distance from each other at Newport's News—about 300 yards apart. This was on Saturday. At about half-past 11 a.m. the rebel steamer *Merrimac* came in sight, and we were all on the alert, watching her movemeuts. There was not very much surprise expressed, as she had been expected for some days. The men were beat to quarters almost immediately, and every preparation made for active resistance. The captain of the frigate, Commander Radford, was not on board, being then occupied on a Court of Iuquiry on board the *Roanoke*. In his absence the command was assumed by First-Lieutenant George U. Morris, executive officer. As soon as the *Merrimac* got within one mile of the *Cumberland* we opened fire upon her from our 10-inch pivot guns and our rifled cannon. Some of the shots struck her, and others passed or fell short. She paid no attention whatever to our firing until she got near the *Congress* when she fired into her. The *Congress* immediately returned the compliment by discharging a whole broadside, followed by another. She continued on her course, still firing at the *Congress*, but seeming uot to care much for her, and on coming much nearer passed by her, and made direct for the *Cumberland* uuder a full head of steam. On approaching sufficiently near she fired one shot at us, which killed five men, and cut away our main rigging, hammock, netting, &c. The *Cumberland* at once replied by firing into her most vigorously. The *Merrimac* then drew off for a short distance, rounded to, and ran into us, striking us on the port bow, backing off again, and firing into ns. We continued all the while pouring shot and shell against her from our 9-inch guns and 10-inch pivots, without produciug any effect on her whatever. The *Cumberland* now began to sink. The iron mouster had only run into us once, and still we knew that there was no chance at all of saving the vessel. Although in this dangerous and momently siuking condition, the men and officers nobly stood their ground. The *Merrimac* continued all this while firing occasional shots into us, killing four or five men at every shot. The cockpit was soon filled with wounded meu, and poor fellows maimed for life were scattered over the upper gun and berth decks. Still our men continued working and fighting their guns in the most gallant manner. Our forward magazine was soon filled with the water which was rushing into the ship, so that it became entirely useless. The best order, under the circumstances, prevailed, but the cries of the wounded were dreadful. At one time a shell burst through the sick bay or hospital, killing four men who were on the sick list aud unable to report for duty. At last the water rushed into the gun deck ports, and it was seen that the ship would not float much longer. She was now all down by the head and going fast to the bottom. The boats were therefore ordered out, and with difficulty brought alongside. It was, however, almost impossible for the men to get from the gun deck to the spar deck, but some of them climbed

into the rigging, and others sprang overboard as the ship was settling out of sight. Everybody was naturally endeavouring to reach the boats; some 50 or 60 men were seen floating and swimming about, catching at spars. The rule now was every one for himself. Quite a number were crushed by the after pivot gun, which rolled about in a dangerous manner.

"The *Merrimac*, seeing that she had finished up the *Camberland*, then drew off finally, and returned to the *Congress*, firing at her as she approached. The two other rebel steamers, the *Jamestown* and *Yorktown*, were now seen coming down the James river, and soon after opened fire on the fort and on the ships. The *Congress* had been fighting gallantly all the while, but now, having had about 100 men killed, and being at the same time so riddled with shot that she was rapidly sinking, was taken in tow by the gunboat *Zouave*, but the firing still continuing she hoisted the white flag and surrendered.

The fight between the *Monitor*, or *Ericsson* battery, and the *Merrimac* was very exciting. The former was in no way injured; but there is no doubt that the *Merrimac* had two or three holes put into her port side.

"During the whole engagement between the *Cumberland* and the *Merrimac* there was but one man seen on the latter vessel. He came out of her hatch, and as soon as he was seen a shot was fired at him, which sent him completely in two.

"To all appearance there were ten guns on board the *Merrimac*, four on each side, and one each at her bow and stern. They seemed to be 9-inch or 10-inch guns, although one or two might have been larger. She began to fire at about 1 o'clock, but we could only occasionally see the men who were working the guns. They were behind their ports, and we could only get a glimpse of them on the recoil of their pieces. Several attempts were made to pick them off with rifle shots, but with what success cannot be ascertained. Every shot fired by the *Merrimac* went through our ship, but we could make no impression at all upon her, although we gave her over 20 broadsides of solid shot and shell from our 9-inch and 10-inch guns. The engagement lasted for about two hours, until the *Cumberland* finally went down with her flags flying.

"It must be mentioned that the *Congress* was not destroyed by the rebels, but by two Union sailors who were sent on board for that purpose —it is supposed by order of General Mansfield."

One of the crew of the *Cumberland* makes the following statement:—

"To our intense disgust, not to say astonishment, the two solid iron messengers, after having been so well directed so as to strike our antagonist fairly and squarely, ricocheted from her roof and disappeared in the distance beyond. On she came, without returning the compliment, and we occasionally giving her a taste of our metal, until within, I should judge, about a hundred yards of us, when she suddenly yawed around, and we had no more than time to count five guns on her side before their contents came crashing through our bulwarks. We gave her as many as she sent, with some by way of interest, but it did not seem to affect her in the slightest. Then the *Congress*, which was lying further down, and the water battery of heavy columbiads on the Point commenced playing upon the monster in a way which must have given those on board a very good idea of a very severe hailstorm. But, bless you, the only notice she took of them was to occasionally throw a shell or two into or over the camps at the News. She entirely ignored the existence of the American frigate *Congress*.

"In less time than I have been writing the last ten lines our antagonist steamed round and came up within 40 yards of us, and gave us another of those terrible broadsides. The shrieks of the wounded were heartrending to hear; but a sailor in action has no time to think of anything but his work, and such of our guns as were not disabled still kept up their fire. But our rival now adopted different tactics. Drawing off a few hundred yards, she put on a full head of steam and came directly at us for the purpose of running us down. She struck our port side, as near as I could judge (for I was thrown completely across the deck from the force of the collision), about opposite the foremast, making a tremendous cavity below our water line. The water came rushing in, in spite of all efforts to prevent it, and it was soon noised around that we were sinking. This rumour had hardly time to go through the ship when the monster had disengaged herself, and was again coming at us at the top of her speed. There was no escaping, of course, but all who were left alive and uninjured managed to seize something wherewith to withstand the force of the blow. On she came, striking us in the waist. The crash was terrific. The good old ship careened over fearfully; men, guns, everything, were tossed about the deck promiscuously. Many were injured.

"Many of the boats had been injured, but in those left such of the wounded as could be readily got at were placed, and all who could get in or around the boats were hurried to the shore. As for me, I climbed up in the rigging, with many others, and was almost displaced from my seat when the ship gave a final lurch."

A correspondent who witnessed the second conflict gives the following full and interesting account, commencing where the *Merrimac* first meets the *Monitor*:—

"At first the rebel craft seemed nonplussed, and hesitated, no doubt in wonderment at the queer-looking machine approaching her. The *Merrimac* then closed the distance between her and the *Monitor* until they were within a mile of each other. Both batteries stopped. The *Merrimac* fired a shot at the *Minnesota*, to which no reply was made. The rebel craft then fired at the *Monitor*; the latter replied, hitting the *Merrimac* near the water line. The *Merrimac* then commenced firing very rapidly, first from her stern gun at the *Monitor*, and then her broadside guns, occasionally firing a shot at the *Minnesota*. The fight went on in this way for an hour or two, both vessels exchanging shot pretty freely. Sometimes the *Merrimac* would retire, followed by the *Ericsson*, and *vice versa*. While the fight between the batteries was going on, one hundred solid 9-inch shot were sent up from Fortress Monroe on the steamer *Rancocas* to the *Minnesota*. At a quarter past 10 o'clock the *Merrimac* and *Monitor* had come into pretty close quarters, the former giving the latter two broadsides in succession. These were promptly replied to by the *Monitor*. The firing was so rapid that both craft were obscured in columns of white smoke for a moment or more. The ramparts of the fort, the rigging of the vessels in port, the houses and the bend, were all covered with sailors, soldiers, and civilians. When the rapid firing alluded to took place these spectators were singularly silent, as if doubtful as to the result. Their impatience was soon removed by full figure of the *Monitor*, with the Stars and Stripes flying at her stern, steaming around the *Merrimac*, moving with the ease of a duck on the water. The distance between the vessels was 40 feet. In this circuit the *Monitor's* guns were not idle, as she fired shot after shot into her antagonist, two of which, it is alleged, penetrated the *Merrimac's* sides.

"At 11 A.M., the *Minnesota* opened fire, and assisted the *Monitor* in engaging the *Merrimac*. She fired 9-inch solid shot with good accuracy, but with apparently little effect. The *Merrimac* returned the fire, firing shell, one of which struck and exploded the boiler of the gunboat *Dragon*, which was alongside the *Minnesota*, endeavouring to get her off. The *Merrimac* made several attempts to run at full speed past the *Monitor*, to attack and run down the *Minnesota*. All these attempts were parried, as it were, by the *Monitor*. In one of these attempts by the *Merrimac* she ran her plough or ram with full force against the side of the *Monitor*, but it had only the effect of careening the latter vessel in the slightest degree.

"At a quarter before 12 o'clock, noon, Lieutenant Hepburn, the signal officer on the ramparts of Fortress Monroe, reported to General Wool that the *Monitor* had pierced the sides of the *Merrimac*, and in a few minutes the latter was in full retreat, heading for Sewall's Point, and chased for a few minutes by the *Monitor*. The *Merrimac* has evidently suffered to some extent, and it was thought at one time that she was sinking. After she got safely under the guns of the rebel battery at Sewall's point she stopped and signalled for help from her consorts, who were beating a retreat. Subsequently two tugboats or gunboats went alongside and took her in tow, and proceeded to Norfolk. This ended the engagement."—*Times*.

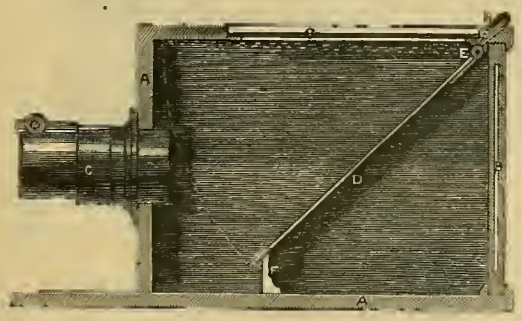
Lieutenant Worden writes as follows regarding the *Monitor* to his brother, one of the publishers of the *Chicago Times*:—"Dear Brother,—She is supposed to be shot-proof. Her hull floats 18 inches above the water, and is covered with five thicknesses of wrought iron plates, each one inch thick, to a point 3½ feet below water-line. Her deck is covered with one-inch wrought iron. A wrought iron turret, 21½ feet outside diameter, 9 feet high and 8 inches thick, is placed near the centre of buoyancy. In this turret are mounted two 11-inch Dalbgren guns. The turret revolves, and is turned around with great facility by steam, its movements being controlled by the commanding officer inside. As she goes into action, there is nothing above her deck, but the turret and a shot-proof pilot house, and when she is anchored outside a fort or battery, the latter is lowered below the deck. In that position, if she is boarded by the enemy, they cannot get below nor into the turret, and her decks can be swept by her own guns loaded with canister. She is propelled by steam, and is expected to go eight knots the hour, and carries eight days' coal at that speed; is flat-bottomed and draws ten feet of water. She is not intended for a crusier, only to go from port to port on our own coast. Great hopes of her success are entertained by her constructor and others, and, if she answers their expectations, she will be a very serviceable vessel, and will have some rough work to do. Length of upper vessel, 172ft.; length of lower vessel, 124ft.; breadth of upper vessel, 41ft. 4in.; depth of upper vessel, 5ft.; breadth of lower vessel at top, 36ft.; breadth of lower vessel at bottom, 18ft.; depth of lower vessel 6ft. 6in. As you may imagine, her apartments are neither spacious, light, nor airy, and we do not expect much comfort in her; but, if her capabilities turn out as we hope for, I shall be well satisfied to rough it. It seems that Commodore Smith, of the Bureau of Yards and Docks, has had the supervision of her construction, and is greatly interested in her success. I had a letter from him, which is quite complimentary in its tone, stating that he had named me for the command, whereupon I examined the vessel and accepted at once, getting my orders by return mail. I apprehend that it is the intention of the department, if she prove successful, to build the 20 iron-clad gunboats recently authorised by Congress on her plan, with modifications suggested by experience."

RECENT PATENTS.

PHOTOGRAPHIC CAMERA.

THOMAS SUTTON, *London.—Patent dated August*, 20, 1861.

THIS invention relates to various novel improvements upon and additions to the cameras employed in taking photographic portraits and instantaneous pictures. The body, A, of the camera, of which a longitudinal vertical section is represented in the annexed engraving, consists of an oblong box of the ordinary shape, having the rear end open for the reception of the dark slide or plate-holder, B, and having an opening in the front end, into which the ordinary lens holder, C, is inserted in the usual manner. So far the camera resembles those in common use; but there is added to it a plane reflector, D, which turns on an axis or centres at E, in the upper part of the camera near its back or open end. This reflector may be made of polished metal, looking glass, or other good reflecting material. When the reflector is in its downward position, or adjusted inside the camera at an angle of 45°, as shewn in the engraving, and the sensitive plate in the dark slide, B, is



in its place behind the reflector with the shutter of the slide open, the reflector should intercept all the rays from the lens, and shield the plate entirely from their action. On turning up the reflector, however, into the position indicated by the dotted lines, or until it touches the top of the camera, the image formed by the lens will be thrown upon the sensitive plate; but when the reflector is turned down until its lower edge touches the bottom of the camera, or rests upon a stop or support, F, fixed thereon, so as to be at an angle of 45 degrees with the bottom of the camera, then none of the light from the lens can fall upon the sensitive plate.

Instead of fitting the focussing screen into the open end of the camera, as is usually done, it is fixed inside a frame or pannel let into the top of the camera, as shewn at G, and consequently when the reflector is turned down at an angle of forty-five degrees with the bottom of the camera, an erect image will be thrown upon the screen in place of the inverted image, which is thrown thereon, when the screen is placed at the back or open end of the camera. This image may be viewed from without at the same time that the reflector screens the sensitive plate from the light which passes through the lens. When the image is properly focussed upon the screen, G, in the top of the camera, it is necessary that the reflector should be equidistant from the sensitive plate and screen, or in an exact midway position between the focussing screen and the inner or sensitive surface of the plate, in order that when the reflector is removed or elevated, a sharp image precisely similar to that thrown upon the screen may be thrown upon the sensitive plate. For the proper fulfilment of this condition, it is requisite that the respective planes of the focussing screen, the sensitive plate, and the reflecting surface of the reflector should have one common centre of convergence, and that the plane of the reflecting surface should bisect the angle formed by the sensitive plate and the focussing screen.

The focussing screen may be made either of plain ground glass or of ground glass of an orange tint, so as to intercept the entrance of actinic rays into the camera. The camera should be mounted upon its stand in such a manner so as to admit of its being easily turned in any required direction, a ball-and-socket joint or other convenient contrivance being used for that purpose. When it is required to take instantaneous pictures, the dark slide should be inserted through the side of the camera in place of through the top, as is usually done, and the shutter must be opened through the side.

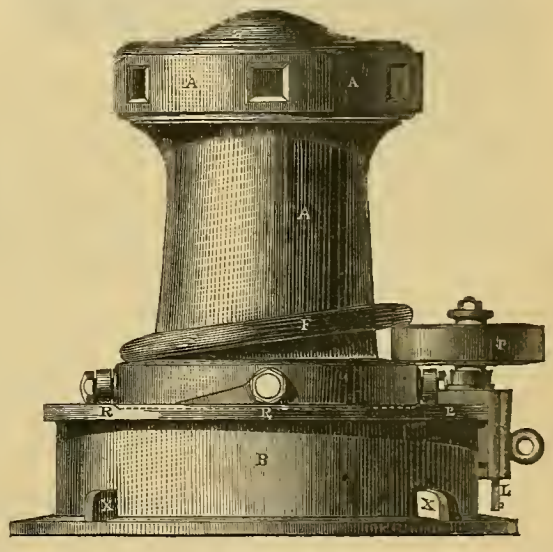
The principal advantage of this camera over the ordinary ones are, that the operator is enabled to see an erect in lieu of an inverted image of the object, whilst the open slide is in its place in the camera, and can focus the lens and afterwards expose the sensitive plate at the proper instant by means of an external handle H, of any suitable form, which is fixed to the axis of the reflector, and which enables the reflector to be readily turned up and down.

CAPSTANS.

J. H. JOHNSON, *London and Glasgow*—(LOUIS F. F. DAVID, *Paris.*) *—Patent dated July* 18, 1861.

THIS invention consists of certain improvements in capstans and windlasses, whereby they will operate continuously without stopping or "surging." In applying this invention the main drum rotates in the usual manner round a fixed stem or axis secured vertically in a suitable cast-iron bed plate or base, and is driven in the ordinary or in any other convenient manner. At the base of the drum is the "float," consisting of an inclined ring embracing the same; this ring turns with the drum, and is kept inclined by resting at one side upon a roller or pulley carried in a moveable carriage, whilst at the opposite or lower side it rests upon a shoulder formed on the base of the drum. The carriage which carries the roller or pulley is supported upon a circular railway formed for that purpose round the edge of the base or bed plate, and is provided with a projecting tongue or stop, which serves to keep it in its place by bearing against one or other of a series of stops or projections in the bed plate. By the aid of the stop on the carriage it may be placed in any desired position for giving the proper inclination to the "float" or ring upon which the rope rests, the inclination of the ring ensuring the free passage of the lowest turn or coil of the rope and enabling the capstan to be worked continuously without fear of the different coils riding or mounting over each other.

The accompanying engraving represents a side elevation of an improved capstan complete, constructed with these improvements applied



to it. The body, A, of the capstan is of the ordinary form, and actuated in the usual manner. The base plate, B, receives the fixed stem or axis round which the drum, A, rotates, and has also a circular railway, R, formed thereon for the purpose of guiding the carriage, C. This carriage, which carries the roller or pulley, P, is arrested by means of the stops, X, formed on the base plate and by the tongue, L. The roller or pulley, P, is intended to give the desired inclination to the "float" or ring, F; it is mounted on the carriage, C, and moves consequently with it. F is the float or ring upon which the cable rests, and which, by its inclination, ensures a free passage always to the lower turn of the cable, and enables the operation of heaving to be continuously carried on without fear of one turn of the cable riding over another. This float or ring turns with the capstan. It rests one side upon the roller or pulley, P, and at the opposite side upon the lower shoulder which carries the ordinary pulls or stoppers. The tongue or stop, L, is fitted to the carriage, C, and admits of the carriage being fixed in any desired position for imparting the requisite inclination to the float, F. As the remaining parts of the capstan are of the ordinary kind, it is not necessary further to refer to them.

BRUSHES.

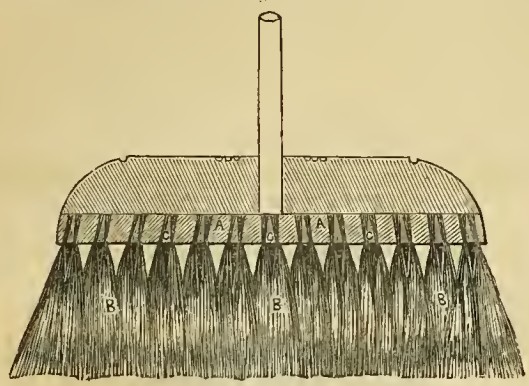
WILLIAM WIGFALL, *Sheffield.—Patent dated July*, 26, 1861.

THIS invention has for its object an improved mode of securing the bristles, bass, or fibres into the head-stock, or handle of brushes and brooms, and consists in inserting a peg amongst the bristles, bass, or fibre into the hole which receives them, so as to act as a tightening wedge thereon, and thereby firmly secure them in their place. These

pegs may be used with pitch, marine glue, or other cement; or they may be inserted dry, and may be composed either of wood, metal, or any other suitable material. They may also be used in conjunction with ruts or grooves, one or more pegs, pins, or wedges being run through or forced into the whole row of knots, parcels, or bunches of bristles, bass, or fibre in the head or stock of the broom or brush.

Fig. 1 of the annexed engravings represents a vertical section of a broom having the bristles, bass, or fibres secured into the head or stock in accordance with this invention.

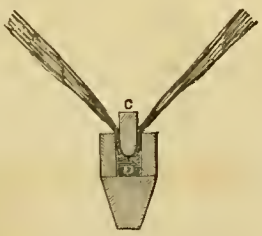
Fig. 1.



In this fig., A is the back or foundation of the brush containing the holes which receive the bristles, these holes being made cylindrical, or of the same size throughout, as shown; B are the tufts of bristles or other equivalent substance inserted into the holes; and C are the pegs or pins which are driven into the centres of the tufts, and into the holes for the purpose of securing the tufts therein. In order that a more effectual wedging or tightening action may be exerted upon the bristles, it is preferred to make the pegs of a slightly tapered form, as shown. In this figure these tapered pegs or pins are represented as being driven in from the under side of the brush, or from that side from which the bristles project, so that any attempt to withdraw the tufts will tend to still further tighten them in the holes at the back, A. Under another arrangement the pegs are driven in from the upper side of the back, A, the holes which receive the tuft being widest at the back from which the pegs are driven; or the holes may be wider on the face, or made conical, whilst pegs are driven into the conical holes in the reverse direction, as in fig. 1, but so as to have the effect of expanding the bristles outward. Oblong pegs or wedges, in conjunction with oblong holes, in place of using round pegs and round holes, as described, are also used in accordance with either of the ways above described of fastening and drawing them into the back or head-stock.

Fig. 2 represents cross section of another mode of securing the bristles, or other equivalent substance into the back of a broom. According to this system, a long peg or wedge, C, is inserted laterally into a corresponding rut, groove, mortice, or slot, D, made in the back of the brush; the bristles being first laid horizontal across such slot, and the long wedge, C, is then laid upon them immediately over the slot, and driven home therein; the nipping of the bristles at their centres causing their ends to rise up and approach each other, as shown clearly in this transverse section, where the wedge is partly driven home. Or, in lieu of the bristles being doubled, as in this figure, they may be made only half the length, and be inserted singly into the slot, and then tightened by the insertion of the wedge.

Fig. 2.



The patentee does not, however, confine himself to any particular form of peg, or wedge and hole, as the same may be made either round, oval, square, oblong, or any other shape which will enable the bristles, or other substances employed, to be wedged or tightened into their holes by the insertion of a peg or wedge therein. If found desirable, two or more such pegs or wedges may be inserted into the same hole.

DRILLING AND TAPPING APPARATUS.

JOHN SOMERVILLE, *Kent.—Patent dated August* 20, 1861.

THESE improvements comprehend a new arrangement and construction of apparatus for drilling and tapping gas and water mains and pipes, whereby the leakage which takes place when performing these operations for the purpose of attaching service pipes under ordinary circumstances and by the usual means is entirely obviated.

Fig. 2. Fig. 1.

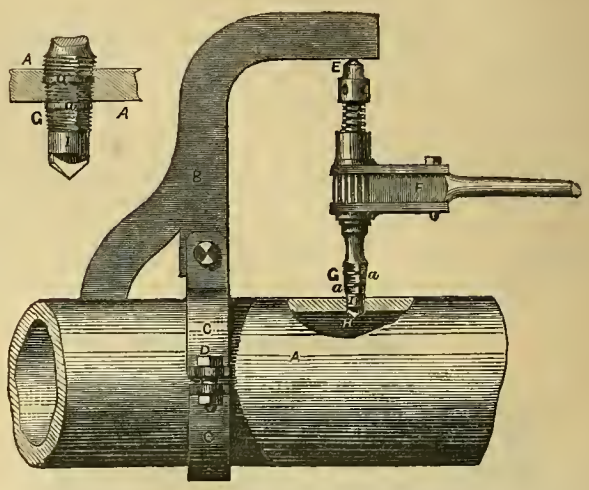


Fig. 1 of the subjoined engravings represents a complete side elevation of the improved apparatus in working order, and fig. 2, is a detail of the drill and tap, showing the india-rubber washers or collars in their respective places drawn to a larger scale than fig. 1.

A represents the water or gas main to be drilled or perforated; B is the bracket or cramp, which is clamped on to the top of the main by the clip, C, and bolt and nut, D, and having a hole centre-punched in it to receive the pivot, E, of an ordinary ratchet brace, F; G is the tap fitted into the brace, and H is the drill which is fitted into the tap and secured therein by a pin or otherwise; *a*, *a*, are two washers or collars of india-rubber or other suitable material, fitted into annular grooves or recesses made in the tap, and I is a circular or short cylindrical piece forming the upper part of the drill, and serving to partially plug the hole and steady the drill therein.

In using this apparatus the pipe is first centre-punched at the part to be perforated and the drill is then applied and rotated in the ordinary manner by the ratchet brace, F, or otherwise. A hole is thus drilled, and as the drill proceeds the cylindrical part, I, enters therein, so as to effectually prevent any leakage and keep the drill steady after its point has penetrated the main, at the same time preventing it from breaking through too soon or until the hole is perfect and ready to receive the tap. As soon as the drill has entirely passed into the main the tap, G, follows up and commences to cut the thread. As the cutting of the thread proceeds, and just before the part, I, has entered the main, the first of the india-rubber or other washers or collars, *a*, enters the hole, and being slightly larger than the hole, it effectually plugs it, and being compressed therein, prevents any escape of gas or water through the slots of the tap. As the tap is turned the washer or collar is carried with it and passes into the main, being immediately followed by the second washer or collar (as shown in fig. 2), one of such being always in the hole till the entire thread is properly cut, when the tap is withdrawn and the service pipe attached in the usual manner.

MACHINERY FOR THE MANUFACTURE OF ARMOUR PLATES.

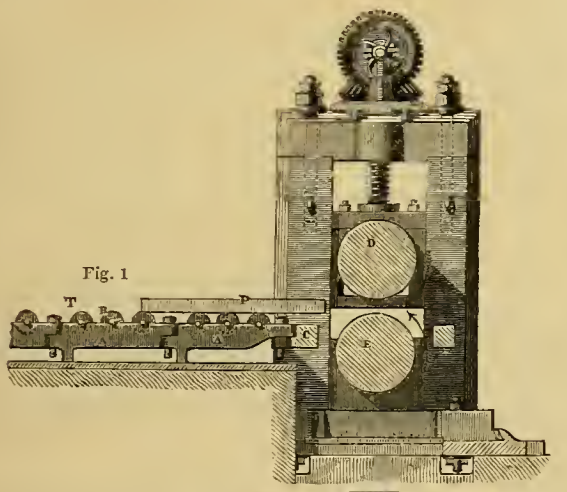
J. H. JOHNSON, *London and Glasgow* (H. U. PETIN *and* J. M. GAUDET, *Rive de Gier, France*).—*Patent dated July* 19, 1861.

THIS invention relates to the manufacture and production of armour plates for ships, and other heavy forgings, in an easy, expeditious, and economical manner, and to certain peculiar constructions and arrangements of machinery or apparatus to be employed in such manufacture. According to this invention, it is proposed to employ a crane and peculiar gripping holders for the purpose of seizing the pile or faggot in the furnace, and of conveying the same to the rolls. As in large forgings it is necessary to heat the iron several times, and to turn it over, or reverse it, at each heat (an operation which entails, in the ordinary system, a vast amount of manual labour); it is here proposed to employ a peculiar apparatus for reversing or turning over the pile and faggot. This apparatus consists of a species of horizontal hinged tipping frame, upon which the pile or faggot is laid, and which is then elevated at one end by means of a chain and a suitable windlass until the frame assumes a vertical position, when, by slightly continuing the

motion of the free end of the frame, the pile or faggot carried by it is turned over on to a suitable bed plate or support. The pile or faggot, on being presented to the rolls, is carried by a jointed table provided with antifriction rollers, upon which the pile or faggot travels up to and through the rolls. By jointing this table, facility is afforded for adjusting it in any position horizontally upon the floor, so as to receive the pile or faggot at the most convenient place, and present it at any desired horizontal angle to the rolls. A similar table may be placed on both sides of the rolls, and the pile or faggot passed to and fro through them, for which purpose a reversing motion, worked by a small steam cylinder, is employed for reversing the rolls as required. In preparing a pile or faggot intended for an armour plate or other similar forging, a rectangular rolled or hammered plate is used, upon which are piled a number of trapezoidal shaped bars, in two or more series, one above the other, but so as to break joint. Upon these bars is laid a second rectangular plate, having a series of strong ribs rolled or formed thereon, or in lieu of a plate, a series of ribbed bars may be laid side by side over the piled bars; and the faggot being now complete, is heated and welded, and rolled together, one of the rolls being grooved in order to preserve the grooved or channelled surface of the plate. This grooved face of the armour plate offers the advantages of increased strength and lightness over those made with plain or flat surfaces.

Fig. 1 of the accompanying engravings represents a side elevation of the moveable and jointed table erected in front of a pair of rolls; and fig. 2 is a corresponding plan of the same. The faggot, P, intended to be

Fig. 1



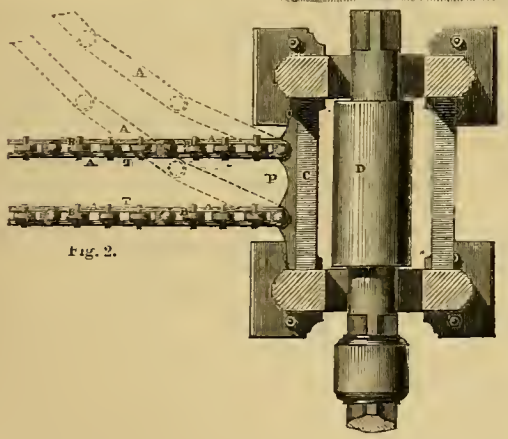
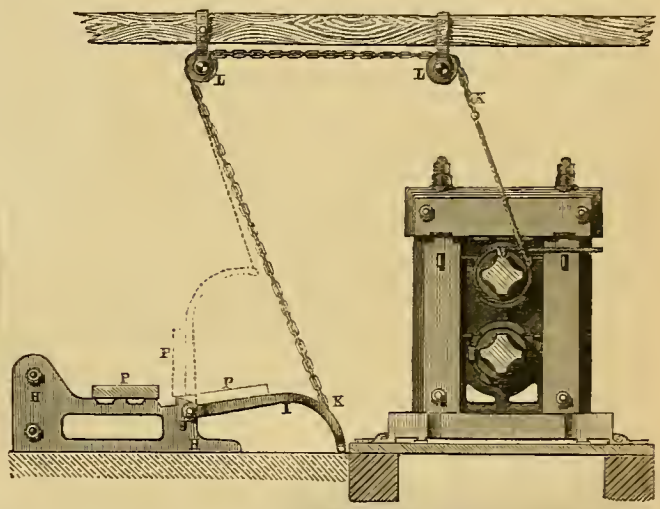


Fig. 2.

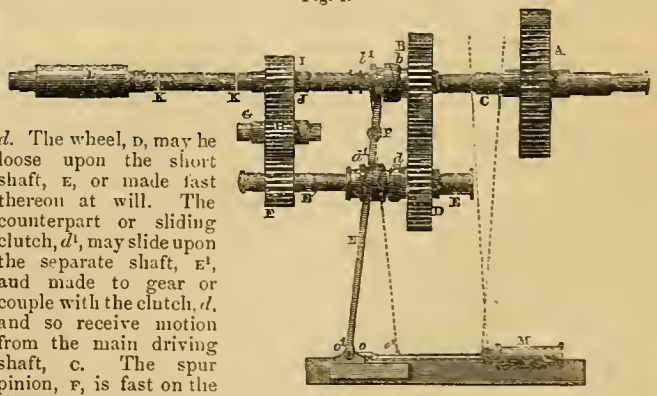
rolled being in the furnace, and having attained the desired degree of heat suitable for welding or rolling, the grippers, which are suspended from a crane, are brought to the furnace mouth, and the workmen who have hold of the arms of the gripper introduce it into the furnace, and cause it to seize the faggot or mass of metal and withdraw it therefrom, when the mass is laid upon the moveable table to be presented to the rolls. This moveable table, T, is composed of a number of parts, A, hinged together, and capable of being brought into any desired position or direction. Each part, A, is provided with rollers, B, upon which the mass of metal is moved up to the rolls. The first of the parts, A, are hinged or jointed to a cross bar, C, which unites the two standards of the main framing of the rolls. The dotted lines in Fig. 2 show the horizontal movement of the table. The mass having been deposited upon the table, T, is brought up to the rolls, D, E, by a very slight expenditure of force. As it would be too heavy to admit of its being returned above the rolls, and being again presented to them on the same side, an alternating circular or reversing motion is imparted to the rolls, so that the mass will be passed to and fro between them—a similar jointed table or support to that shown in the engraving being situate on the opposite sides of the rolls, so as to receive the mass of metal as it passes through them. As heavy forgings require several heats before they are finished, and as it is advantageous, for the obtainment of perfect homogeneity of the metal, to turn over or reverse the mass before returning it to the furnace; for this purpose, the peculiar turning or reversing apparatus represented in side elevation at fig. 3 is employed. This apparatus consists of two plates or standards, H, connected together by cross bars, and forming an open

Fig. 3.



frame. The forked lever, I, which oscillates upon the axis, J, has attached to one end the chain, K, which, after passing over the guide pulleys, L, is connected to a rope wound round the drum, M, on the axis of one of a pair of rollers, as shown in fig. 3. The mass of metal or heavy forging, P, being laid upon the lever, I, it will be obvious that on drawing the rope tight round the drum or axis of the shaft, M, the lever will be caused to turn upon its axis, and the forging will be brought into the vertical position indicated by the dotted lines. On continuing the motion of the lever a little farther, the forging will be turned over and fall in a reversed position upon the frame or supports, H, as shown in section lines, without the aid of manual labour. The forging, P, is now laid hold of by the grippers, and returned thereby to the furnace again. Fig. 4 represents a side elevation of an arrangement of self acting reversing gearing for driving a pair of alternating rolls. The large spur wheel, A, receiving its motion from the prime mover transmits it to the cast steel spur wheel, B, fixed upon the same shaft, C. This last wheel gears into the spur wheel, D, to which is fixed the clutch.

Fig. 4.



d. The wheel, D, may be loose upon the short shaft, E, or made fast thereon at will. The counterpart or sliding clutch, d^1, may slide upon the separate shaft, E^1, and made to gear or couple with the clutch, *d*, and so receive motion from the main driving shaft, C. The spur pinion, F, is fast on the shaft, E^1, and gears into the intermediate wheel, H, which serves to change the direction of rotation. A third spur pinion, I, may receive its motion either through the pinion, H, or directly from the shaft, C, of the wheel, A, and coupling

boxes, *b*. This pinion, I, transmits its motion to the couplings of the intermediate shaft, K, which are in connection with the rolls, L. M is a small steam cylinder, the piston of which is made to traverse either forward or backward by suitable valve regulating hand gear similar to that in use in steam hammers. The end, O, of the piston rod works in a guide, and is connected to the extremity of a powerful lever, M, working on a fixed centre at P, actuating both the sliding clutches, b^1 and d^1, as is clearly shown in the engravings. The alternating circular motion is imparted to the rolls from the main shaft in the following manner. An attendant, in charge of the small steam cylinder, M, admits the steam at the back of the piston, when the end of the piston rod will be brought into the position at o^1, the effect of which is to couple the clutch boxes, b^1, in which case the motion is transmitted direct to the rolls, L; the clutch boxes, d d^1, being disengaged, as shown, the spur wheels and pinions, D, F, and H, will be out of action, and turning without transmitting motion through them. If, on the other hand, the attendant admits the steam on to the front side of the piston in the cylinder, M, the end of the piston rod will be brought into the position, o^2, and the lever, N, will assume the position indicated by the dotted line when the clutches, b^1, will be disengaged, and the clutches, d d^1, engaged, the motion being in that case transmitted through the spur wheels, B and D, and as the shaft, E^1, will be coupled with the shaft, E, the pinion, F, keyed thereon, will transmit motion to the pinion, H, and through it to the pinion, I, and thence to the couplings of the shaft, K, to the rolls. An alternating motion is thus transmitted to the rolls by the simple adjustment of the valves of the cylinder, M, whilst the main driving shaft, C, continues to revolve in one direction only. If the wheel, D, is loose upon the shaft, E, then, in that case, the latter should be in one piece with the shaft, E^1.

The improved form of armour plate, the manufacture of which is greatly facilitated by the apparatus hereinbefore described, presents greater solidity with a given thickness, as compared with armour plates of the ordinary manufacture. These improved armour plates may be designated as grooved or ribbed plates, and are made in the following manner. A wrought iron plate, F, of from two to two and a-half inches in thickness is first produced under the steam hammer, or by the aid of rolls (see fig. 5); upon this plate are piled a number of bars of balled iron, A, of a trapezoidal form, arranged in two, three, four, or more layers or ranges, according to the dimensions of the plate to be produced, care being taken to cross the ranges and break joint, as shown. Upon these bars are laid, side by side, a series of longitudinally ribbed wrought iron bars, B. The particular form illustrated by the drawing is not, however, absolutely essential, as the form may be varied more or less. A pile is thus obtained, the weight of which should be sufficient for the armour plate to be manufactured therefrom. It is heated in a suitable furnace to a welding heat, and is then seized by the grippers hereinbefore referred to, and is conveyed to the rolls. The upper roll is so shaped as to correspond to the grooves or ribs on the surface of the plate, and the mass is rolled until it is reduced to the desired thickness of the armour plate, and the entire mass is intimately welded together, the result being a plate having grooves or ribs on one face, as shown in fig. 6, which will offer greater resistance to shot, and will be lighter than ordinary armour plates of an equal strength.

Fig. 5.

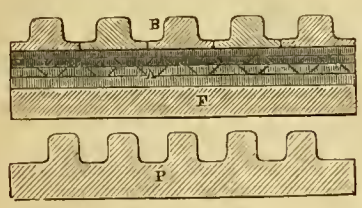


Fig. 6.

This invention also includes an improved moveable gripper, mounted upon a carriage, which is found particularly well adapted to the handling of heavy forgings. The carriage consists of a frame, mounted upon two or more wheels, and carrying an arm for the purpose of transporting the same. A pillar serves as the support for the two bars, provided with the holders or grippers attached to the bars by keys or nuts. Levers secured to the opposite ends of the bars permit of their being turned in any convenient direction, in order that the grippers may close or open, and grasp or release the forging as required. In using this apparatus, the grippers are wheeled up to the mouth of the furnace, and the attendants who have hold of the levers cause the grippers to seize the forging, which is then elevated by depressing the outer ends of the bars; and on the carriage being wheeled back, the forging is withdrawn from the furnace, and conveyed to the rolls; or the grippers may be opened so as to deposit the forging upon the jointed table, T, of the rolls, which is then pushed along until it is brought into a position to be seized by the rolls. A modified form of travelling grippers is also described, which differs from the former only inasmuch as it is provided with a single lever or bar, in lieu of having two; this lever terminating in a species of fork or trident, which is inserted under the bottom of the forging in the furnace; and when the forging is safely deposited thereon, is withdrawn, and wheeled up to the rolls, or to the jointed table, hereinbefore referred to.

SAFETY FUSES.

Joseph Victor *and* James Polglase, *Cornwall.—Patent dated March* 22, 1861.

This invention consists of improvements in the construction of fuses for mining and other blasting operations, the object of the improvements being to obtain a fuse possessing a greater efficiency, and subject to fewer objections than those previously in use.

The mode of manufacture which is adopted is as follows:—A metallic tube, composed of lead or of any metal or metallic alloy possessing sufficient ductility (although we prefer the use of lead), and of any desired bore or calibre, is filled or charged with gunpowder or other explosive substance or compound adapted for such purposes. The tube thus filled or charged, and having the ends closed by compression, is passed between a series of rollers with graduated grooves, whereby the diameter and bore of the tube are reduced to any required minimum. By this process of rolling, the gunpowder or other explosive substance or compound is so tightly compressed as to give slow or steady combustion instead of sudden explosion. The amount of rolling ordinarily required is so much as is sufficient to increase the tube about four times its original length, but this may be varied as circumstances require or render desirable.

By the method above detailed, a perfect and complete continuity of the gunpowder or other explosive substance or compound is obtained throughout the entire length of the tube, which may be thus manufactured of any desired length.

The process of manufacturing tubes is well understood by mechanists, and therefore need not be here more particularly described, inasmuch as it forms no part of this invention, which consists of the tube and gunpowder or other explosive substance or compound rolled together until the tube is reduced or elongated to the required size. The fuses can be, as has been stated, constructed of any length, and possess great flexibility, while from the material of which the tubing is composed they are impervious to moisture, and may be packed and stored with perfect safety, the ends of the tubing being sealed or closed by a simple concussion, or even by being cut with a blunt instrument. The latter peculiarity is of importance in cases of accidental injury, such as sometimes occurs in the operation of tamping, the tube upon being struck collapsing, and thereby cutting off the communication from one part of the fuse to the other.

Another important feature connected with this fuse, and which is of great value, as tending to prevent accident, is, that it has no combustible clothing or covering to cause it to "hang fire," and then explode suddenly and unexpectedly.

It should be remarked that by the method of manufacture adopted, absolute continuity of the charge throughout the entire length of the tubing is ensured, and also that, however the fuse may be exposed to damp or moisture at the time of use, or even if carried under water, the charge is so effectually protected that its operation will be equally certain and efficacious. The amount of gas and smoke evolved upon ignition is also much less than with the ordinary fuses, their use in "close ends" and other confined localities being consequently especially desirable and beneficial. These advantages render the safety fuses of great value, not only for mining but other blasting operations.

We think this is likely to prove an important invention; and that Victor and Polglase's patent fuse may hereafter prove a formidable competitor to the Bickford fuse, or possibly even supersede it. We have no doubt the former can be made by much the cheaper, provided it can be made at all with assured safety. It has been fully established by experiment, by Dr Faraday amongst others, that percussion—even by a not very hard body, such as a piece of hard wood—a powerful and sudden compression is capable of firing gunpowder. We are not at all certain that it may not prove that the rapid and powerful compression the grains of powder must here undergo, in the process of rolling down through the tube, and compressing its contents, will occasionally fire the powder within. We do not suppose, however, even if this prove so, that it must necessarily prevent the manufacture, for ignition, under these circumstances, would not be attended with any powerful explosion, and the fuse, in the rolling process, might be isolated from all other explosive bodies. It seems to offer some decided advantages over the plaited, or woven, and tarred envelope of the Bickford fuse. Several of these have been pointed out in the specification—the chief ones appear to us to be the absence of anything combustible in the fuse, except the train of powder, so that fire cannot "haug" in the case of a miss fire; and that these tubes may be used for exploding powder under water, at depths where the Bickford becomes uncertain, and again, that these metallic-cased fuses may be stored and kept irrespective of climate or of

time. Very much of their success, however, will turn upon the question of how thin the metallic tube can be rolled down to, still preserving sufficient strength for carriage and use. If not *very* thin, the weight of a few score yards of the new fuse will be considerable, and have not only the consumption of metal large and bulky in proportion, but carriage, etc., becomes objectionable. We suppose it does not admit of doubt that this form of fuse would be safer, when surrounded by siliceous matter in the act of being tamped, than Bickford's.

After all, we have long been convinced that the day is not very distant when galvanic fuses, for priming and igniting common blasts, will become an article of commerce, and when ignition by the Rhumkorf's coil, or the electro-magnet, with revolving armatures, will be found so simple that any navvy can easily employ it, and that such will be found the cheapest, most certain, and safest of all methods of blasting. We could point out at this moment, how such fuses could be made no thicker anywhere than a piece of Bickford, and length for length, for as little, if not far less cost; and as for the galvanic firing apparatus, when once arranged as a quarry tool, its cost originally, and in work, would be perfectly insignificant.

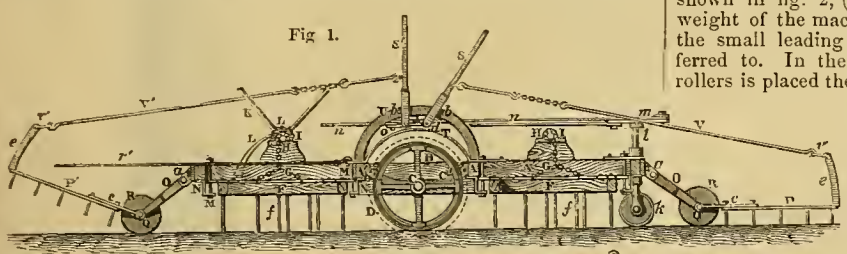
In close situations, this priming would superadd the advantage of producing no smoke, limiting the latter merely to that of the charge —En.

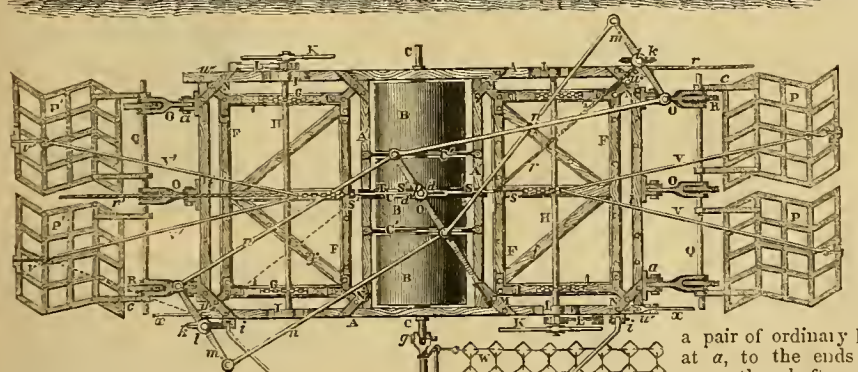
LAND CULTIVATOR BY STEAM-POWER.

J. A. Williams, *Baydon, Wiltshire.—Patent dated June* 4, 1861.

This invention relates to a peculiar construction and arrangement of compound implement for effecting the further reduction of the soil by steam power after it has been ploughed, and consists in the combination in one machine or implement of a land roller or rollers, land pressers, clod crushers, Norwegian harrows, spiked rollers, or other similar revolving implements for reducing the soil, with drag frames

Fig 1.





placed in the front and rear of the rollers, and harrows suspended to one or both ends of the main framing of the implement, the front harrow being lifted up whilst the hind one is in action. The main framing of the implement is of a rectangular form, supported in the centre by the roller shaft, and provided at each end with suitable steering wheels. This frame carries at the front and rear of the rollers one or more drag frames working within the main framing according to one modification from a lever joint. These drag frames are raised or lowered for adjusting their depth at the lever joint by a nut and screw or other suitable mechanical contrivance, and are raised and lowered at their opposite or free ends for the purpose of clearing the same from weeds by means of a chain and pulley worked by a lever handle, carried by the main framing. According to another arrangement these drag frames are lifted vertically at both ends simultaneously in suitable guide or slotted bars by the aid of chains and pulleys or windlasses on the main framing. A double seat for the steersman is constructed over the roller, and is so arranged as to enable him to steer and work the implement in either direction, the same being hauled to and fro without turning by steam power. When spiked rollers or Norwegian harrows are used, or the roller is in any way displaced, a pair of ordinary travelling wheels are employed for carrying the frame. In using the presser wheels, it is preferred to carry them in lever frames, each wheel having an independent vertical action of its own, but they may also be fitted loosely upon the roller shaft or main axle above referred to.

Fig. 1 of the accompanying engravings is a longitudinal vertical section of a compound implement for effecting the cultivation of land by steam power in accordance with one modification of this invention, and fig. 2 is a corresponding plan of the same.

A, A^1, represent the main framing of the machine; it is of a rectangular form in plan, and is divided into three compartments by the two cross bars, A^1. The centre compartment or space contains either a set of three land rollers, B, as shown in fig. 2, or in lieu thereof land pressers, clod crushers, Norwegian harrows, spiked rollers, or other rotating implements for operating upon the soil, may be substituted. These land rollers are supported by and rotate freely upon one common axle, C, which passes through them, and is carried in bearings on the under side of the main framing in the curved bearing bars, C^1, attached to the two centre beams, A^1, of the main framing. The two opposite extremities of this axle are each made to receive a supporting or running wheel, one of which wheels is shown in dotted lines at D, (fig. 1); these wheels are of larger diameter than the rollers or other revolving implements employed, so that such rollers or other implements may be clear of the ground when the wheels are applied, and thus enable the machine to be transported to any desired locality without injury to the implements. When in actual use the running wheels are removed, as shown in fig. 2, (excepting in the case of spiked rollers,) the entire weight of the machine being then supported by the land rollers, B, and the small leading and trailing disc steering wheels, *k*, hereinafter referred to. In the compartments or spaces on each side of the land-rollers is placed the drag frames or cultivators, F, provided with straight tines, *f*. These drag frames are suspended by means of the chains, G, from the overhead shafts, H, which are carried by and rotate in the bearings, I, bolted to the upper side of the main framing. K are lever arms secured to the ends of the shafts, H, for the purpose of rotating the same when raising or lowering the drags from or into the soil, and L are ratchets and detents for maintaining the drag frames at any desired elevation so as to enable their tines to penetrate more or less deeply into the soil, or to be entirely out of action by being elevated above the surface of the land; at each of the four corners of the two drag frames there is a vertical guiding spindle, M, fixed in brackets, N, which are bolted to the main framing, and passing through guide plates in the corners of the drag frame, P. These vertical guiding spindles serve to steady and guide the drag frames during their rising and falling motions and to connect them securely to the main framing, A, so that they may move along with it when being hauled across the land. To each end of the main framing of the machine or implement are connected by means of the links, O, a pair of ordinary harrows, R, R^1. These connecting links are jointed at *a*, to the ends of the main framing, whilst their opposite ends carry the shafts, Q, which are supported by the running wheels, R, and to which shafts the arms, *c*, of the harrows, R, R^1, are jointed so as to admit of the harrows turning freely thereon, and of being elevated above the ground, as shown at R^1 in fig. 1, when not required to be in action. In order to facilitate the elevation of both pairs of harrows either together or separately as may be required, two vertical levers, S, S^1, are employed, connected at their lower ends by pin joints, *d*, to the curved bar, T, and guided by the upper curved guide bar, U, which passes through the lower forked extremities of the levers. To each of these levers is connected a rod or chain, V, V^1, extending to the upper ends of the bent arms, *e*, to which they are connected, such arms being secured to the outer ends of the harrows, and enabling the strain of the lifting rods or chains, V, V^1, to be applied in an advantageous manner upon lifting the harrows; either or both pairs of harrows may be maintained in an elevated position by simply inserting a stop pin, *b*, into a hole in the guide bar, U, in front of the corresponding lever, as shown in relation to the lever, S^1, in fig. 1. To one side of the main framing of the implement or machine is fitted a chain harrow, W; it is linked on to the bar, X, which is jointed at its inner end by a pin, *g*, to the end of the main axle, C, of

the machine; a wheel, Y, on the outer end of the bar, X, serving to support it parallel with the surface of the ground; *z*, is a stay connected hy a bolt or pin at *h*, to the bar, X, and jointed at *i*, to lugs in the side of the main framing. This stay maintains the har, X, perfectly firm and rigid horizontally, but allows it to rise or fall at its outer end in accordance with the inequalities of the ground, the pin joints or connections at *i* and *g*, respectively, serving as hinges for the frec vertical play of the bar and chain harrow.

The steerage of this implement is effected simultaneously at the front and rear ends of the main framing hy the two disc steering wheels, *k*, carried in the lower forked ends of the vertical spiudles, *l*, which are supported in the brackets, bolted to the diagonally opposite corners of the framing. Ou the upper ends of the spindles, *l*, are keyed the cross arms, *m*, which are connected by the rods, *n*, to the central horizontal steering lever, *o;* this lever works on a vertical stud centre, *p*, fitted or formed upon the curved har, T, and is prolonged to form a steering handle at *q*; this lever handle imparts a steering motion to both the steering wheels simultaneously through the coupling rods, *n*, which are so disposed as to adjust the steering wheels in opposite directions, by which means a more instautaneous and effective steering action is obtained than when one stecring wheel only is in action at one time. Iu using this implement the whole or auy suhordinate comhination of the separate implements contained therein may he hrought into action as found desirahle. It is intended to he hauled to and fro across the land without turning hy the aid of wire ropes, *r*, *r*, respectively attached to the implement at *s*, *s*, and wound upon separate drums or windlasses actuated by a suitahle steam engine. The line of draught may be varied to suit the requirements of the implement by passing thc hauling rope round a stud or pin, *t*, which is capable of heing fitted into any one of a series of holes made to receive it in the end bars of the main framing, as shown in fig. 2. In order to facilitatc the taking of fresh ground at the headlands for the next traverse of the implement, a stud or pin, W, is permanently fixed at or near the inner corner of each end of the framing, over which stud or pin the hauling rope is thrown so as to bring tbe line of draught on to one side of the implement, and therehy ensure its more speedy entrance into fresh ground when the windlasses are again startcd. This position of the hanling rope is indicated hy a dotted line in fig. 2. The rope, *r*, which in fig. 2 is shown as the slack or tail rope, is passed when so acting over a pin, *w*, on the extreme outer side of the main framing so as to be deposited clear of the side of the machine, hut when it is to he adjusted into the proper position for acting as the hauling rope, it will be necessary to unhook the eud, *v*, of the liuk, V, from the arm of *e*, of the harrows in order to allow the rope passing over such arm to its proper hauling position. So soon, however, as the implement has takeu up its proper position for the next traverse the hauling rope is slipped over the end of the pin, *u*, hy the action of the small lever handle, *x*, when the rope will instantly resume its hauling position against the pin, *t*, which should be made higher than the pin, *u*, so as to catch the rope when released from the last-mentioncd pin. By this arrangemeut the implement may be made to take up a fresh position, and then to continue its direct course without stopping the engine, thc attendant being simply required to depress the disengaging lever immediately he sees that the inner side of the implemeut is iu a line with the outer edge of the work last completed.

Fig. 3.

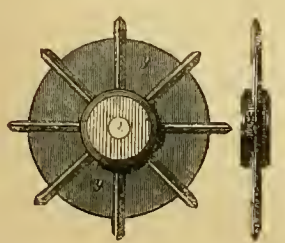
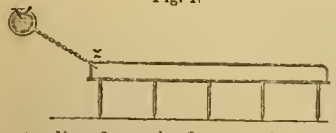


Figure 3 represents a detail side elevation and edge view of one of a series of spiked rollers which may he suhstituted if desired for the land rollers. B, shown in figs. 1 and 2, a number of these spiked rollers, which are formed with wehs, *x*, hetween the spikes, heing strung on the axle side hy side, when by their rotation arising from the movement of the implement over the grouud they will effectually disintegrate the soil. When using spiked rollers or "pressers" of any kind, it is necessary to apply the running wheels, D, to preveut tbem from penetrating too deeply into the soil.

In some cases it is proposed to dispense with the chain harrow represented in fig. 2, and to remove the harrows, P and P¹, from their present position at the euds of the machine, and to place a pair of such harrows at the side of the machiuc so as to occupy the position of the chain harrow. Fig. 4 represeuts a side view of one of these harrows adapted by the har, X. For this purpose a har is placed on the top of each harrow, extending from the front to the rear end, and having a ring, *z*, running loosely thereon, such riug being connected by a chain and a second larger ring on to the bar, X¹. This arrangement enables the harrows to be drawn from either end to aud fro without turning the machine.

Fig. 4.

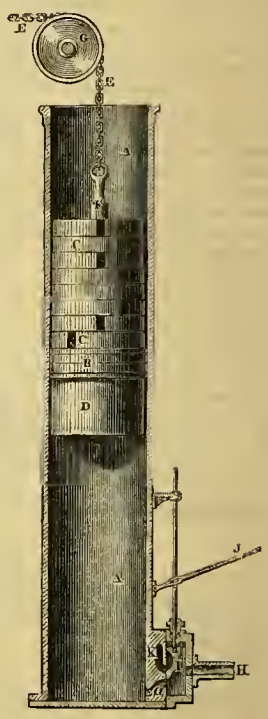


MACHINE FOR RAISING AND LOWERING HEAVY BODIES.

Samuel S. Robson, *Sunderland.—Patent dated September* 26, 1861.

This invention relates to a peculiar construction and arrangement of direct acting, or gravitating crane, capable of being worked either by steam, air, gas, or water, and consists in the employment of a cylinder, of a length equal to the greatest lift required by the crane, in combination with a piston and counter-weight—the piston working accuratcly within the cylinder and the counter-weight, being heavier than the heaviest weight to he raised.

The suhjoined engraving represeuts a vertical section of the working, or hoisting cylinder, of the ordinary mode in which it is proposed to carry out this invention. The traverse of the piston being equal to the greatest lift required.



The long vertical cylinder, A, is accurately hored throughout its entire length, and fitted with a piston, B, working steam or fluid tight therein. The portable weights, C, of any convenient size, rest upon the piston, are capable of being shipped or unshipped in the usual way by a side slot formed iu one side, as required. There is also a halance weight, D, consisting of a hlock of metal suspended heneath the piston, and tending to steady the same in the traverse iu the cylinder, whilst it at the same time halances the weight of the pendant chain, and serves to overcome the friction of the piston in the cylinder. The hoisting chain, E, is secured at one end to the piston-rod, or stem, F, whilst its other end is provided with a hook, gripper, or slings, for facilitating its attachment to the hody to be elevated. At o is represented one of a pair, or series of fixed guide-pulleys over which tbe chaiu is passed, and which lead it to the locality where the goods to be elevated are situate. The steam, or other fluid to he employed, is introduced underneath the piston by the pipe, H, and a suitable valve, I, is employed for alternately directing the steam, or other fluid, iuto the cylinder beneath the piston, and allowiug it to escape therefrom; the valve heing worked hy a lever, J. When the steam is admitted iuto the cylinder, A, hy raising the lever and valve, J and I, it elevates the piston and counter-weights, B, C, D, and correspondingly lowers the opposite end of the chain so as to enahle it to he attached to the weight to he raised. The valve, I, is then reversed so as to close the inlet passage, *a*, with the steam-chest, and open it to the outlet, or escape passage, K, whereupon the pistou and counter-weight being no longer supported by the pressure of the steam heneath, descend hy their own gravity, and as their weight is greater than that of the load attached to the chain, it follows that the latter will he elevated a distance proportionatc to the downward traverse of the piston Another modification of this crane, as adapted to situations where loug cylinders cannot conveniently be employed, iu which latter case the traverse of the piston ueed only he one half of the greatest lift required. This is accomplised by attaching the inner end of the chain to some fixed point above the cylinder, and then passing it down one side, and heneath a pulley, fitted into the top of the stem, or piston-rod, and finally, up again on the other, and over the guide pulley, O, as in the first modification; the lift ohtained hy this arrangement will be douhle the traverse of the piston. The valve is worked hy the attendant through the long hand lever, J, which gives him complete control over the crane, and when the steam is confined within the cylinder by closing the port, *a*, with the valve, I, from the steam, or exhaust, H and K, the weight may be kept suspended and stationary at any desired height, and raised or lowered at will by the simple adjustment, or motion of the regulating valve, J, hy the hand of the attendant.

LAW REPORTS.

Paraffin Oil. *Re* Young's Patent. Before the Attorney-General, 27th March, 1862.

This was an application for the fiat of the Attorney-General authorising the issue of a writ of *scire facias* to repeal the above-mentioned patent. The application was made on behalf of Mr Gillespie, the owner of a portion of the coal field in which the Torbanehill mineral is found. In the year 1861, Mr Gillespie applied to the late Attorney-General, Sir Richard Bethell, for his fiat to issue a writ of *scire facias*, but the application was refused on the ground that an action was then pending in Scotland, the object of which was to repeal the Scotch patent of Mr Young, the Attorney-General declining to allow simultaneous proceedings for the same object to take place in England and Scotland.

The particulars of this case are reported in the *Practical Mechanic's Journal*, Vol. 6, New Series, p. 98.

The present application was based upon reasons varying in some important particulars from those alleged in support of the writ in the former case. Mr Aston, instructed by Messrs Simpson and Traill, appeared for Mr Gillespie; Mr Webster and Mr Lawson, instructed by Mr J. Henry Johnson, represented the owners of the patent.

On the opening of the application, it appeared from the evidence that, although the action in Scotland above-mentioned had been abandoned, still, since that abandonment, Mr Gillespie had, in July, 1861, raised a summons of reduction before the Court of Session in Scotland against the patentees, the object being that the Scotch patent, which is for the same invention as the English patent, should be annulled, such proceedings being in fact of the same nature as the English action of *scire facias*. It further appeared that, in August, 1861, he had obtained the concurrence of the Lord Advocate in the summons. It did not appear that any formal abandonment of this proceeding had ever taken place. The patentees' counsel, as a preliminary objection, therefore urged that the present application must be refused on the same ground as that upon which the Attorney-General acted in the former case. The counsel for Mr Gillespie read an affidavit of that gentleman, stating that there was now no action at law pending in the Scotch courts at his instance to repeal the Scotch patent, and urged that the proceeding had been in effect abandoned, inasmuch as no steps had been taken in the action after obtaining the Lord Advocate's concurrence therein. It was also stated that no more formal abandonment could be made, no means being afforded by the Scotch law of formally determining such a proceeding by a plaintiff.

The Attorney-General, Sir W. Atherton, without calling on the counsel for the patentees, said it appeared to him that he ought not to depart from the principle on which the late Attorney-General proceeded. It was clear that there had been no actual abandonment of the Scotch action, and he therefore declined to grant his fiat. With reference to an observation of the applicant's counsel that there were no means by which the proceeding could be abandoned formally, the Attorney-General said that if it were so, and the applicant could not possibly retrace his steps, then he must go on with the Scotch proceedings. It was entirely the applicant's fault that the proceedings had been taken in Scotland. He was not bound to take them, and he had been cautioned by the late Attorney-General not to do so, if he wanted that officer's fiat in England. The application would therefore be refused, with costs.

Copyright in Works of Art.—This important subject has just been taken up by the Solicitor-General, whose proposed bill has been read a first time. It is quite time that something should be done for the amelioration of the existing law which is so excessively imperfect and so absurdly anomalous. A copyright has been created in books and other subjects. With respect to the fine arts, two series of Acts have been granted, giving a copyright of a limited and special nature. In 1735 an Act was passed giving a copyright in prints and engravings, but awarding no protection to the pictures from which they were taken. In the present reign that protection was extended to lithographs. Another series of Acts gave copyright to sculptures, models, and casts. This is the extent to which works of fine art are protected in this country. It is a singular thing that while an engraving enjoys protection, the picture from which it is taken is divested of any protection at all. That is the present state of the law. This evil is almost peculiar to England. Foreign countries, by international copyrights, are enabled to give us whatever we give them. In almost all these countries the principle of copyright extends through the whole range of the fine arts, and especially exists in regard to pictures. The periods for which copyright is given in this country varies rather arbitrarily. According to the new Bill the period of copyright for pictures, drawings, and photographs, is measured by the period of life and seven years beyond. This is one period adopted in Mr Serjeant Talfourd's Act giving a copyright in books. No doubt this limited protection for life and seven years beyond will be satisfactory to artists, and this protection will extend to every painting, drawing, and photograph, to be hereafter made and for the first time disposed of. It has not been thought expedient to make the Act retrospective, so as to give a copyright either to the painter or the purchaser of pictures already parted with. The Bill proposes to give the purchaser the copyright as a matter of course, unless the copyright is especially reserved by the author. It is not proposed to extend the protection beyond paintings, drawings, and photographs. The Bill will give the ordinary legal remedies and penalties to secure copyright. Another object is to put a stop to a considerable trade which had grown up in spurious pictures, the manufacturers of which counterfeit the marks and monograms of artists of eminence, whose reputation suffer from the fraud, while the public are imposed upon. Now, this offence will be a misdemeanor, and the law protects artists against frauds. It is of considerable importance in the present year that such a Bill as this should be passed with despatch; otherwise foreign artists, who have a copyright in their own country in those works which we are most anxious to see in the Great Exhibition, must either withhold their contributions, or expose themselves to the danger of having their rights invaded.

Literary Copyright: Howitt *v.* Hall *et al*: Injunction.—This was a motion on the part of the plaintiff, Mr Wm. Howitt, in the Vice-Chancellor's Court, before Vice-Chancellor Sir W. P. Wood, for an injunction to restrain the defendants, Messrs Hall and Virtue, the publishers, from selling or otherwise disposing of any copies of an original work called *A Boy's Adventures in the Wilds of Australia*, of which Mr Howitt is the author and registered proprietor. It appeared by the affidavits that in the year 1854 a negotiation was entered into with the defendants by Mrs Mary Howitt, the wife of the plaintiff, who was then in Australia, for the sale to them of the copyright of the work in question, for four years, for a sum of £250. This negotiation, after some discussion as to the precise date from which the contract was to commence, resulted in an agreement being entered into by the plaintiff, which was afterwards confirmed on his return from Australia by the following memorandum signed by him:

"Gentlemen,—I confirm the agreement entered into with you by Mrs Howitt, on the 14th of March, 1854, for the publication of *A Boy's Adventures in Australia*, being a copyright of four years from that date.

"William Howitt."

And on the some day the defendants sent for the plaintiff's signature a receipt for the £250, "being the purchase money, as agreed, for the copyright and sole right of sale for four years" of the work in question. In October, 1857, the work having then gone through two editions, the defendants contemplated issuing a third and cheap edition, and accordingly gave notice of their intention to Mr Howitt, by whom it was revised previously to publication. No future copies had been printed, and the term of four years expired in March, 1858. In February of this year the plaintiff, being about to bring out a uniform edition of the juvenile works of Mrs Howitt and himself, and having, as he stated, only then for the first time discovered that the defendants were continuing to sell the work and to advertise it for sale, wrote to them complaining of this as an infringement of his copyright and a breach of contract, and asking for compensation. In reply to these applications the defendants insisted on their legal right to sell the remaining stock, as their own *bona fide* property, when and as they pleased; but at the same time expressed their willingness to sell it by auction during the present month of March, so as not to stand in the way of the new edition. This suggestion, however, the plaintiff declined to accede to, and filed his bill praying for an account of the profits made by the defendants since March, 1858, and for the injunction which was now moved for.

On behalf of the plaintiff it was contended that, according to the true construction of the agreement, the defendants were not only restricted from printing or publishing any copies of the work after March, 1858, but also from selling any of their remaining stock. It was at their own risk that they overstocked themselves, and they must bear the loss. To hold that the assignment of a copyright for a limited term was to confer upon the assignee the right of continuing after the expiration of the term the sale of any number of copies, however large, which he might have previously printed, would be a great hardship on the author, and might have the effect of entirely depriving him of all benefit in the copyright.

The Vice-Chancellor said that the purchase of the copyright carried with it the right of printing and publishing, and the defendant was entitled to continue selling after the expiration of the four years' term the stock printed by him under his purchase. The Copyright Acts were directed against unlawful printing, and when, as in this case, the defendant had acquired the right of lawfully printing the work he was at liberty to sell at any time what he had so printed. It had been suggested that the effect might be to destroy the copyright in the author altogether, as the publisher who had purchased the copyright for a

limited period only, might, during that period, print off copies enough to last for all time. But a publisher was not likely to incur the useless expense of printing copies enough to exhaust the demand for all time, and have them lying upon his hands unprofitably. Besides this, even if the effect of a sale for four years might operate in this way to deprive the author of all copyright in his work, the answer was that he had not guarded himself against such a contingency. If a manifest case of fraud upon the author were established, the Court would know how to deal with it. But nothing of the sort was shown. The defendants had acted quite *bona fide*, and were making a perfectly legitimate use of their contract, and the motion must be refused. Costs to be costs in the cause.

The ruling of the Vice-Chancellor in this case, puts a complexion upon the legal meaning of the term "copyright," for which, we think, most people will be unprepared. "The Copyright Act," he says, "was directed against unlawful printing." In this instance, there was no proof of "unlawful printing," *ergo*, the plaintiff had no case. We certainly had always understood hitherto that "copyright" involved the full and complete commercial control over the work concerned. Sir W. P. Wood does not think so.

Trade Marks.—The following are the leading provisions of the bill brought in by Mr. Roebuck and Mr. Hadfield :—2. Whosoever, with intent to defraud, or to enable another or others to defraud, any person, shall forge or counterfeit, or procure or caused to be forged or counterfeited, any trade mark, or shall make or procure or cause to be made any imitation of a trade mark, so resembling such trade mark as to be likely to deceive, or shall apply or procure or cause to be applied any trade mark, whether the same be a genuine trade mark or not, to any chattel or article not being the manufacture, workmanship, production, or merchandise denoted or intended to be denoted by such trade mark, or to any case, cover, wrapper, cask, bottle, reel, stopper, or other thing in, on, or with which any chattel or article shall be intended to be or shall be sold, or uttered or exposed for sale or for any purpose of trade, shall be guilty of a misdemeanor.—3. Whosoever, with intent to defraud, or to enable another or others to defraud, any person, shall sell, or utter or expose for sale or for any purpose of trade, any chattel or article, together with any forged or counterfeited trade mark, or any fraudulent addition to or alteration of a trade mark, or with any imitation of a trade mark so resembling such trade mark as to be likely to deceive, or with any trade mark, whether the same be a genuine trade mark or not, which shall have been applied without lawful authority or excuse (the proof whereof shall lie on the party accused), and whether such trade mark or imitation be in, on, or about any case, cover, wrapper, cask, bottle, reel, stopper, or any thing in, on, or with which such chattel or article shall be sold, or uttered or exposed for sale, or for any purpose of trade, shall be guilty of a misdemeanor. 4. Every offence hereinbefore declared to be a misdemeanor may be prosecuted in a summary manner, instead of being made the subject of indictment as a misdemeanor; but if so prosecuted, such offence shall, on a first conviction under this act, be punishable by a penalty only not exceeding £20, to be levied by distress upon the goods and chattels of the offender; and on a second or any subsequent conviction under this act, a penalty not exceeding £40, to be levied as aforesaid, or imprisonment for a term not exceeding three calendar months; all penalties shall be paid to the prosecutor.

Copyright: Artistic.—Artistic copyright wrongs have for many years afforded a wide scope for discussion, and it is now felt that the injustice of the case can no longer be tolerated. The coming opening of the International Exhibition has naturally aroused public attention to this important question, and it will be well if the matter can now be definitively and for ever settled. According to the statutes as they stand, an artist acquires a copyright in a work of sculpture, if he models it on his own account; if it be a commissioned work, the employer is entitled to the copyright. The same law affects the reproduction of paintings or drawings by the process of engraving. The system works badly in every way; and it is gratifying to find that reformers really are now bestirring themselves with the view of clearing away this great defect. It is clear to us that the only just and efficient means of remedying the existing evils is to give a secure copyright in the *design* of works of Fine Art. Indeed, in the abstract, the point can hardly be said to have ever given room for discussion; but in projecting the details necessary for carrying out the proposition in practice, artists have somewhat quarrelled with the public. Artists object to comply with the necessary legal requirements as regards registration in a public office appointed for the purpose. Here, we cannot but think, that they are decidedly wrong; and it really requires no argument to support this view. We now have a pretty firm conviction that a clear measure for the full protection of property in all artistic designs, if registered, so as to define, unmistakeably, the real right of the artist, will shortly be introduced, and duly converted into law.

Electric Telegraphs: Wheatstone and others *v.* Wilde —Infringement.—This was an action in the Court of Exchequer, before the Lord Chief Baron and a special jury, for the infringement of two patents taken out by Professor Wheatstone, for certain improvements in electric telegraph apparatus. It was set down for the last sittings, and having been tried two days, was adjourned, and was specially appointed for to-day. On the case being called on,

Mr Baron Wilde said it would be better, if possible, that it should be referred.

After a long conversation between the learned counsel,

Mr Bovill suggested that the learned judge should meet Mr Grove and himself in his private room, which his lordship assented to, and on their return into court,

Mr Grove said a reference had been agreed to on terms.

Mr Baron Wilde said that when he suggested that the cause should be referred he had not done so with respect to the probable length of the trial, or the impossibility of trying it, but the extreme complication of the instruments, as well as the peculiarity of the subject, which was highly scientific, rendered it, in his judgment, utterly impossible to try it before a jury.

The jury were then discharged without coming to a verdict.

Cotton Spinning Machinery: Jones *v.* Walker.—Infringement.—This was an action in the Court of Exchequer, before the Lord Chief Baron and a special jury, for the infringement of a patent for an improvement in cotton machinery. The improvement consisted of that portion of the machine comprising the motion for forming the conical ends of the cop.

The plaintiffs are cotton spinners, and the defendant is a machine maker, at Bury. The plaintiffs' patent was granted in 1841, and expired in 1855. The plaintiff by his witnesses proved the identity of the defendant's machine with that patented by him.

The defendant called witnesses, and proved that the very machine which the plaintiff relied on as being an infringement of his patent had been made and in work prior to the date of the plaintiff's patent.

Upon this the plaintiff elected to be nonsuited.

Carpets: Crossley *v.* Dixon.—Infringement—Appeal.—This was an appeal before the Lords Justices, from a judgment of Vice-Chancellor Wood. The object of the suit was to obtain relief against the defendant, Mr Dixon, a carpet manufacturer at Kidderminster, for alleged infringements of the patents of the plaintiffs, Messrs Crossley, carpet manufacturers at Dean Clough Mills, in Halifax. The facts, complicated and involved, were little aided by a voluminous correspondence. The bill stated that Dixon and Co. applied to Messrs. Crossley, in 1852, for a license to use their patent inventions for the manufacture of Brussels and velvet pile carpets; that no actual license was granted, but after negotiation, the plaintiffs supplied the defendant with some looms upon the principle of their several patents, on the terms of the defendant paying the price of the looms and a royalty on every yard of carpet made from them; that the defendant had also bought carpet looms from Messrs. Sharpe, Stewart, & Co., of Manchester, alleged by the plaintiffs to be constructed so as to infringe their patent rights; and that the plaintiffs had sued that firm at law, and on reference the plaintiffs were awarded a large sum for damages. The prayer of the bill was either that it might be declared that the looms sold by the Manchester firm were constructed on the principle of the plaintiffs' patent, and that the defendant was bound, by the terms of his constructive license, to account for and pay the royalties, or that, if the license did not extend to those looms, the defendant might be restrained from infringing the patents of the plaintiffs. The Vice-Chancellor held that the defendant was a licensee from the plaintiffs, and was bound to pay the royalties, and the defendant appealed, alleging that there was no license at all, nor any application for one, but only an agreement for a license, and only, in any case, an agreement to pay a royalty for the machines actually sold by the plaintiffs. He also contended that he was at liberty to question at law the validity of the plaintiffs' patent, and that, at all events, if there were a license or agreement for a license, the whole affair had terminated in 1854, when Messrs. Sharpe, Stewart, & Co. openly offered their machines for sale, made in conformity with their patent, which they alleged to be free from any objection by the plaintiffs or any other person holding any patents.

Their Lordships said that it was always with extreme regret that they differed with Vice-Chancellor Wood, but they were of opinion that the plaintiff should be at liberty to bring any action he might be advised. The appeal was ordered to stand over, but their Lordships purposely abstained from offering any opinion on the validity or the invalidity of the letters patent mentioned in the pleadings.

MECHANIC'S LIBRARY.

Arithmetic: Its Principles and Application, 12mo., 3s , cloth. Hickie.
Electricity; Its Phenomena and Laws, new edition, fcap. 8vo., 2s. Sidney.
Farming, British, Illustratod, 8vo., 12s , cloth. Wilson.
Geology, Student's Manual of, new edition, cr. 8vo., 12s 6d., cloth. Jukes.
Illuminating made easy, Art of, oblong 8vo., 1s 6d., sewed. Canton.
Indigo Planter's Mirror, (Nil Durpan,) 8vo., 1s 6d , sewed.
Iron Breakwaters and Piers, 4to., 2s., sewed. Webb.
Mathematics, Course of Elcmentary, second edition, 8vo , 2s., cloth. Young.
Navigation and Nautical Astronomy, 7th edition, royal 8vo., 16s. Raper.
Ornament and Decoration, Flowers for, fcap. 8vo., 2s 6d., cloth. Maling.
Plane Trigonometry, Lessons on, fcap. 8vo., 2s 6s., cloth. Butler.
Solar Spectrum, trans. by Roscoe, 4to., 5s , sewed. Kirchhoff.
Timber Trees, British, 12mo., 1s 6d. Blenkarn.
Telescope, Stars and the, second edition, 12mo., 1s 6d., sewed. Slugg.
Vegetable Products in Common Use, 16mo., 2s 6d., boards. Archer.

REGISTERED DESIGNS.

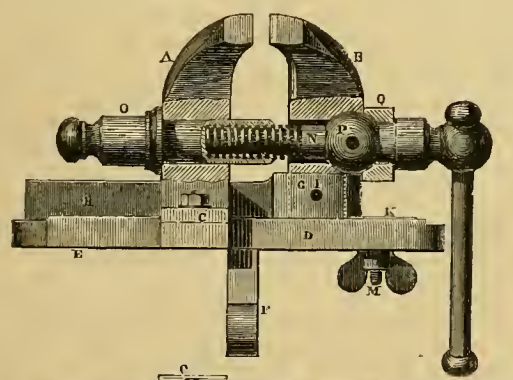
PARALLEL VICE.

NICHOLSON & EVANS, *Havelock Works, Sheffield, Proprietors.*

THE purpose of utility to which the shape or configuration of the new parts of this design has reference is the obtainment of a more perfect grip or hold on parallel or tapered articles in a simple and economical manner.

Fig. 1 of the accompanying engravings represents a longitudinal elevation, partly in section, of the improved vice; and fig. 2 is a plan of the same. A is the fixed jaw, and B the moveable jaw. The jaw, A, is secured by bolts at C, to the bed, D, which is provided with screw holes at E and F, for the purpose of fixing the vice to the surface and front of the bench respectively. The lower end of the shank of the moveable jaw has a circular hoss, G, formed upon it, which boss fits in to a corresponding opening in the head of the parallel guiding slide, H, so as to admit of the jaw, B, adjusting itself to a tapered object, by turning

Fig. 1.



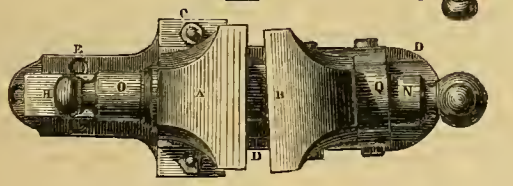


Fig. 2.

partially in the head of the slide, as shown in fig. 2. When required for parallel objects, or for ordinary use, the moveable jaw may be fixed parallel to the fixed jaw by inserting a pin in the hole, I, through the head of the slide, and through the boss of the jaw. The slide, H, works through a suitable aperture in the lower portion of the fixed jaw, and has a dove tailed groove cut in the under side into which is fitted a dove-tailed projection, K. This projection is contained in an opening in the bed of the vice, and is formed with a screw spindle, which enables the projection to be held down firmly by the action of a wing nut, M, beneath. By this arrangement, the moveable jaw and slide are held firmly down, or clamped upon the bed, so as to prevent any tendency they may have to lift or rise from off the bed when drawn out to their widest extent. This dove-tailed projection and slot and groove also serve to prevent any lateral displacement of the moveable jaw and slide. The main screw, N, works in the ordinary screw box, O, and is formed with a ball, P, which fits into a corresponding spherical socket made partly in the face of the moveable jaw, and partly in the inner face of the washer, Q, which latter is held in its place by the screws at *a*. This ball and socket joint arrangement admits of the adjustment of the moveable jaw, B, for a tougher grip.

REVIEWS OF NEW BOOKS.

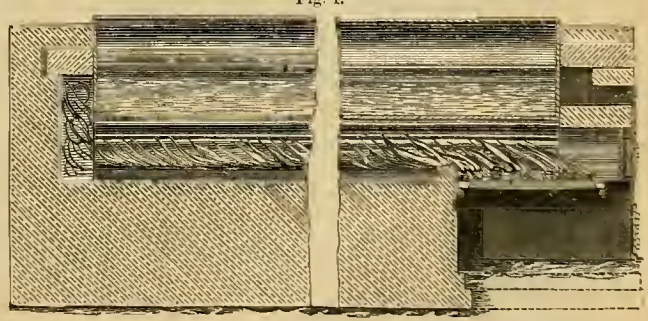
A SHORT TREATISE ON THE CONSTRUCTION OF STEAM BOILERS, AND A DESCRIPTION OF SMYTH'S PATENT CORRUGATED RETORT BOILER. By S. R. Smyth, Engineer, Dover. 8vo, pp. 12. Plate. London: 1861.

MR SMYTH is of opinion that, of all the failures attending the working out of improvements in steam as a motive power, that of the boiler is the greatest; and we are not prepared to deny that the boiler is the weak part of the system. Engineers can, and do, understand the details of the engine itself, but, unfortunately, in the hulk of their present attempts at improvement, whilst they elaborate, in the highest degree, all the mechanical refinements which modern ingenuity can devise, they do this on the broad supposition that the real power—the steam—will somehow come of itself. We do not mean to say that much has not been done, and is even now doing, in the way of causing coal to give a better account of its work in the evaporation of water than it has hitherto done; but we do mean to say, that the bestowal of so large an amount of attention upon the engine, or the developer of the power, however creditable, has been accompanied by a large disregard of that higher practical science which alone can show us how best to create power.

In discussing the form of boilers, and the application of heat therein, Mr Smyth reminds us that modern practice departs widely from Watt's well-known, original principle of applying the primary heat of the furnace to the bottom of the boiler, so as to insure a uniform heat by the circulation of the water; and that, in our present boilers, we are too much in the habit of applying the heat ineffectively, on the upper surface. This is but partially true; and more than this, the multi-tubular system, although it obviously does not do away altogether with upper surface application of the heat, yet it so far splits up the mass of water into thin strata, that the defect referred to is practically reduced within a very small compass. In spite of the author's quotation from Mr Williams, on the drawbacks of multi-tubular boilers, we can still afford to dismiss the point by asking, in a plain way, how we should be off for steam, if the tubular system were not? How come his own propositions for improvement?—

"I was led to believe that the construction of our steam boilers was not in accordance with the laws of heat, and proved it by a Cornish boiler, for I found that when the heat was first applied that, while the top water was boiling, the bottom was perfectly cool; I have also proved the same fact in a tubular boiler, and this proved that a great amount of heat was wasted for the want of a proper application and a boiler so constructed to take it up. The principles I have constructed my boiler upon are, an arch, counter arch top and bottom, the small arches or corrugations running longitudinally the whole length of the boiler, forming direct courses for the heated products of the furnace to pass; not only would it be of sufficient strength to resist any amount of pressure used were it only *plain*, but the small arches or corrugations increase its strength tenfold, and also its heating surface. There is also

Fig. 1.



another feature belonging to it, namely, provided the enormous pressure of steam is brought to the bursting point, the corrugations would either yield by collapsing or straightening, and would not burst with that tremendous suddenness which takes place in boilers bound equal on all sides. Another feature which it has is, that the whole of the boiler is

placed *above* the *furnace*, and the flues are all on the ascent, a circulation of the water and an easy escape of the steam must naturally follow, as there is no impediment; it also has an abundance of room both in furnace and flues for the mixture of the gases.

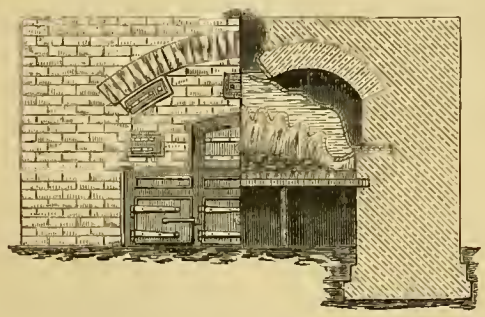
"Our engravings represent, in fig. 1, a partial longitudinal section of a stationary boiler, with the two side flanges which carry the boiler on the piers. It has a steam chest running the whole length of the boiler, the proportions of which are as follows, viz :—20 feet long by 6 feet 6 inches wide across the two extremes of the two external curves next the flanges. The flanges are about 12 inches wide, and running the whole length of the boiler. The curve and corrugations are so formed on the upper and lower plates so as to give not less than 12 inches clear water space, all the corrugations on the arch are nearly equal with each other, except the two next to the flanges, where the upper and lower curves are bent to form a circle about 12 inches diameter, the flanges running therefrom.

"The steam chest is circular, rising to 2 feet above the boiler, having flanges turned upon it to fit and rivet into the rise of the two second curves from centre one on top of the boiler.

"The centre corrugation under steam chest of boiler is cut elliptically, or long oval holes, three in number, equally divided under steam chest, and in no case is the line of corrugation broken. The centre of the steam chest will have a man hole, and the two circles next to flanges will have mud holes. The amount of positive heating surface is enormous, as is proved by comparison with a Cornish boiler of the same power; the heating surface in a Cornish boiler, both primary and secondary, 20 feet long by 6 feet diameter, with 3 feet flue or tube, is 290 feet super; surface buried in brickwork, 90 feet; condensation surface, including one end and bottom part of tube or flue, 206 feet; given 296 feet super of surface which does not come in contact with the heat at all, and the positive heat which is applied is at the wrong place, namely, at the upper part of the water, and contrary to all natural law.

"Fig. 2 shows the end elevation and transverse section of the boiler, as fixed in the brickwork; the mode of fixing it is very simple. Build two piers, lay it on and arch it over, there is not an inch of surface

Fig. 2.



exposed for condensation, and it is as a retort in the midst of fire. A bearing bar runs from the piers which carry the furnace bars which take the whole width of it, running back 2 feet 6 inches, or twice the length could be added, therefore the generative value of the boiler would be materially increased, and also the power; plenty of space can be given between the fire bars and crown of boiler for the proper mingling of the gases; the ash-pit is divided into three separate divisions, so that any one portion of the grate bar surface can be closed, that is supposing any one division of the fire grate becoming thin it could be closed, and the fireman would have a perfect control of the furnace.

Fig.3.

"Fig. 3 represents a section of a locomotive boiler, with hot water tank underneath; this is in every respect the same as the marine. Here the tender or tank is brought below the boiler, instead of the engine dragging it behind; this would decrease both weight and expense. The same principles which belong to the land boiler are applicable to this."

No doubt, Mr Smyth will succeed in what he has aimed at, the obtainment of a larger area of really effective heating and steam producing surface; but we are afraid that the corrugations will make the plates weak in the direction of their width.

A Manual of Chemistry. By Wm. Odling, M.B., F.R.S., Professor of Practical Chemistry at Guy's Hospital. Part I.

This is a chemical classic. The present Part I. is under 400 pages; with the two others promised, it will therefore complete a system of chemistry with 1200 octavo pages, which, if the succeeding parts keep the promise of the first, will be, beyond doubt, the best balanced and most systematic elementary treatise on chemistry in the English language.

The inevitable leaning of every chemical author, who is also an original discoverer, to give an undue prominence to his own researches and results, has marred the symmetry of some of our best systems by English authors. It were invidious to quote instances. Here, however, we have nothing of the sort.

The book is one of pure chemistry; it pre-supposes a competent acquaintance, on the part of the reader, with the laws and facts of physics, and at once plunges into chemical phenomena. This we hold to be completely right. The day is past when a chemical system should begin by an incomplete treatise on physics, mixed up with a sort of chemical cookery book on manipulation. Physics, wide and embracing as it has now become, and resting on mathematics, must now be learned apart, and thoroughly, as the premising step to all good chemistry; and manipulation must be learned, and has its own true and special literature, notably the work of our much-reverenced Faraday.

Dr Odling's work is just that by which, at the educational period of life, the stock of sound chemistry shall be laid in that may be drawn upon for the concrete uses of after life; but for those whose chemical education has aged, for some quarter of a century or so, it is not the book for mere reference.

The system of unitary formulæ will a good deal disturb their "auld warld" notions. Any real advance that shall tend to remove the arbitrary and non-essential distinctions between mineral and organic chemistry, must be recognised as highly important; upon the surface, at least, the system of unitary formulæ appears to look in this direction. Yet, although we express the doubt with some hesitation, when we find not only Dr Odling, by such names as Williamson, Hofmann, and Brodie having none, it seems to us that unitary formulæ, and "the indiscriminate application of series types and substitutions to both branches of chemical science," perhaps rather *seem* to bring them nearer together, than do so in reality.

Nor, we confess, do we see any special approach to the truth, as it is in nature, by abandoning throughout the algebraic sign of addition, as used to express (in notation) combination. Why should the juxtaposition of symbols, i.e., the sign of multiplication express combination (of the intimate nature of which we know absolutely nothing) one bit better, or more truly, than the sign of addition?

As a rule, the atomic weights selected for volatile elements represent single volumes, and those for volatile ones double volume of their respective gases or vapours.

The systematisation of elements and their compounds is rigid, elegant, and founded on native truth Hydrogen stands at the base, as it were, of all, that light, subtle, metal-shrouding gas; and then follow, in order, the monohydric elements, chlorine and its congeners, the dihydric, oxygen and its congeners, with a capital resume as to ozone; and then the trihydric elements, nitrogen, phosphorus, etc. Technological applications are but sparingly noticed. The book is one to teach a science, not to form a repertory of parts for immediate application. Dr Odling has produced an educational system of a truly elegant character, and one that must add to his reputation.—Ed.

A Manual of Metallurgy. By Geo. Hogarth Makins, F.C.S.

This unpretending octavo volume contains a great deal of useful matter, clearly, if not with scientific rigour, arranged, and will be found instructive and even pleasant reading, by a large number of persons, to whom Dr Percy's far more massive lore and systematic science would be "de trop."

The work applies itself more specially to the precious metals, and to those, with their alloys, used in dental surgery; and for the practitioners of that art it has probably been mainly intended. There is a pretty full chapter at the end on electro metallurgy. A very well printed and cheap book.—En.

The Year-Book of Facts in Science and Art. By John Timbs. 8vo, pp. 288. Plate and Wood Engravings. London: Lockwood & Co. 1862.

Mr Timbs' "Year-Book" is one of the most welcome of the many volumes which annually bring us their stories of progress in practical science. Long as the author has been before us, we have never found him to flag in his agreeable manner of telling us passing "facts in science and art;" and this year he comes as fresh as ever. The present volume very happily opens with a chapter on Mr Fairbairn, illustrated by an excellent engraved likeness of that most distinguished practical engineer. The most of the contents is divided into mechanical and useful arts, natural philosophy, electrical science, chemical science, natural history, geology and mineralogy, astronomical and meteorological phenomena, and an obituary list. We cannot recommend a

better book for the use of the general reader to making himself acquainted with the movements of the practical science of the day.

The Intellectual Observer: Review of Natural History, Microscopic Research, and Recreative Science. 8vo, pp. 84. Monthly. Coloured Plates and Wood Engravings. London: Groombridge & Sons. 1862.

This is the first instalment of a new and promising serial—the scope of which is clearly expressed in the title which we have quoted. It embraces eleven different original articles, with notes of the proceedings of various learned societies, and other passing particulars of the day. The articles are—"The Work of the Year—Prime Movers—On Flukes—The Roman Cemetery of Uriconium at Wroxeter, Salop—the Skipper, Skopsta, or Saury; a Rotifer new to Britain; Notes on the preceding Paper—Ancient and Modern Finger-Rings—the Earth and the Comet's Tail—Jottings on Copper—and the Transit of Mercury on November 12, 1861." The immediate object of the work is the promotion of intellectual observation, by furnishing guiding data, suggesting procedure, and recording results, and taking in the speculative, along with the practical, in its range. It is intended to go into the subjects of archæology, astronomy, botany, chemistry, geology, meteorology, microscopy, and natural history in the most extended sense. Judging from the part before us, the new project would seem to be well fitted for the supply of information on the subjects which we have mentioned. The chapter, "On Flukes," by Dr Spenar Cobbold, opens up a very interesting subject for thoughts, in giving actual details of a numerous group of fully organised diminutive animals which take up their abode in the interior of other living animals. This paper, which is illustrated by a very well executed coloured engraving of the "amphistond conicum," tells us for the first time of the extensive range over which these curious animals exist. It is indeed surprising that nature should ever have allowed such an eccentric arrangement to grow up, as it has done, into a regular system "Ancient and Modern Finger-Rings," also, will well repay perusal. What we have said will give a good idea of the scope of the new work, for which we are of opinion that there is plenty of room.

The Lessons of my Farm: a book for amateur agriculturists. By Robert Scott Burn. Small 8vo, wood engravings, pp. 334. London: Lockwood & Co., 1862.

The love of the country is so universal, the delight in dabbling in farming and gardening, of doing something in direct connection with the soil and its natural productions, is everywhere so widely spread, that we cannot but look upon this effort of Mr Burn's, comparatively trivial as it may appear in the eyes of the great practical farmer, as supplying a most important want in the libraries of the general community. Nearly every one has an innate desire to know something about farming, and it is well that it is so, for even if they who do take a delight in the pursuit do happen to pay something for its enjoyment, it would be difficult to find another amusement which is at once so healthy and enjoyable, and which better deserves whatever attention can be paid for it from other and weightier affairs. Results both interesting and valuable may be arrived at by experimental investigation, even on the smallest scale, and it is to the mass of the people who care to devote a little pains to the subject that Mr Burn now addresses himself, telling them that—

"Little farms afford to the amateur a never ending series of delights, and much practically useful information. The fields, as he rambles through them, may not only minister to his health, but may teach him lessons in connection with the most interesting of arts, worth remembering; and worth paying for too, even if he does so in the shape of a high rent, or of experiments which are made only to be registered in the list of 'farm failures.' There is, moreover, a positive pleasure worth paying even somewhat dearly for, in raising one's own produce. As one cracks, at the breakfast-table, the eggs laid by the hens of the farm, spreads the bread with the butter or enriches the coffee with the cream obtained from the milk of the cow—one is very apt to think that it is somewhat better than eating stale eggs at high prices, or using butter or milk not always good, but always dear. Of course all this pleasure is to be paid for, and, as I have already pretty broadly hinted, paid for at a somewhat high rate. For I am much of the opinion, that while pleasures of no ordinary kind are derivable from the possession of a 'play-farm,' profits of the highly satisfactory golden-coloured kind, so much written about lately, are not quite so easily extracted from them. The fields of our amateur's farm are somehow or other more remarkable for their absorptive than their productive qualities. If amateur farming, then, has its delights, it is but right to say, at the outset, that it frequently has its losses also. And on this point, the reader making up his mind to 'play at farming,' as some one has kindly designated the efforts of amateurs, must also make up his mind to stand no small amount of sly innuendos, if not more open jeers; for it is surprising the delight which non-amateurs take in giving one sly pokes on this tender point. In short, if amateur farming is taken up only with the view of making money by it, it had better be let alone. For, as the work of the amateur farm must be done, in nine cases out of ten, by hired labour, little profit will result. Let it satisfy the amateur farmer if he makes ends meet; and do not even let him grumble if he pays some ten or twenty pounds a-year more for his farm than he would do otherwise for a house alone. The truth is, that the health derivable, and the pleasures, too, from the fields of a pet farm, are worth a good deal. Men *will* spend money some way, and I know none more productive of real satisfaction—moral as well as physical—than farming a 'wee bit land.' Putting all things together, amateur farming does pay, though not always in the pecuniary sense."

We quite agree with him in this, and believe that with this little volume before them, many a one will be induced to investigate those doings of nature assisted by art, which they have hitherto passed by. Mr Burn divides his very readable volume into fourteen chapters—about sundry matters, culture of grain crops, wheat, oats, barley, rye, harvesting, root or green crops, haymaking, management of meadow land, implements used in the culture of crops, manures, principles of cattle feeding, care and fattening of stock, treatment of calves and young cattle, varieties and characteristics of fattening cattle, dairy management, choice of cows, the feeding of cows, butter making, crops for feeding dairy cattle, cattle soiling, machines for preparing cattle food, dairy implements and utensils, poultry and pigs, farm work records, and monthly memoranda of field work. The portions of the volume devoted to the mechanical agents of the farm are necessarily brief, as machinery must enter but to a very limited extent into operations conducted on the scale of the amateur. We are glad to see that he speaks favourably as to the practical value of "Sigmas' Multum in Parvo" implement, illustrated sometime ago, in this *Journal*. The machines for the preparation of food for stock, and the tools of the dairy are well illustrated and described, and these sections are the more valuable, as they convey the results of actual practice to beginners who hesitate as to what to adopt. The book, withal, is written in a kindly pleasant tone, with just enough of practice to make it useful, and just enough of pleasantry to incite the attention of the general *reader*.

Shot Proof Gun Shields, as Adapted to Iron Cased Ships for National Defence. By Captain Cowper Phipps Coles, R.N. 8vo. pp. 12. Lithographs. London: 1860.

Spithead Forts: Reply to the Royal Commissioners' Second Report on our National Defences. 8vo pp. 34. Mitchell, London: 1861.

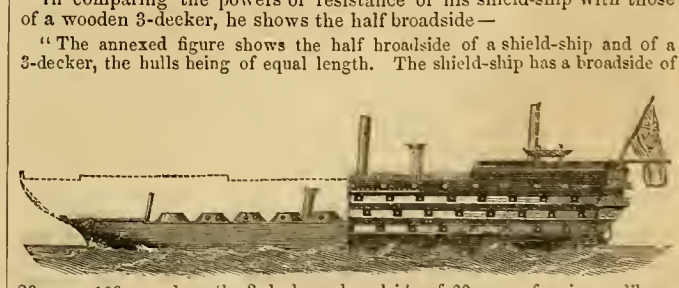
Our National Defences. 8vo. pp. 40. Lithographs, same Author. Mitchell, London: 1861.

It is nothing strange to find that what has just been developed in the *Merrimac* and *Monitor* affair, has long been theoretically known to our Government in the shape of the inventions of Captain Coles. Admiralty and Ordnance Boards certainly have much to plead as to inability to deal with the immense mass of schemes submitted to them, embracing, as the great bulk of mere paper theories do, the grossest and most impracticable absurdities. Still, it is not very complimentary to our ship and gun authorities, to find that a practical scheme which has been so strongly pressed upon their attention by practical men, should have been so long ignored here, and finally developed in America. However, it has been brought to and stood the test of actual warfare; and, as will be seen elsewhere, the British Government is now bestirring itself to take advantage of the lesson read to it by the United States.

In tracing the history of great inventions, it is curious to see how, on the principle of necessity being the parent of improvement, great emergencies have forced out great things. When stern want knocks at the doors of nations, then come the productions of human ingenuity, *rari, et rariores, etiam rarissimi*. It was thus when the Russian War made Captain Coles think of his "shot proof gun shields," so long hidden in the cold shade of official routine; and it is thus that the fighting experiments of the Americans have let some light into that obscurity, and have forced upon us the necessity of turning a practical success to our own account. Captain Coles' pamphlet, No. 1 in the heading of the present article, very fully details his matured plans, and as these are accompanied by very clear drawings, what he says and shows is most interesting matter for comparison with the American doings.

In comparing the powers of resistance of his shield-ship with those of a wooden 3-decker, he shows the half broadside—

"The annexed figure shows the half broadside of a shield-ship and of a 3-decker, the hulls being of equal length. The shield-ship has a broadside of



20 guns, 100-pounders, the 3-decker a broadside of 60 guns of various calibres. I will first call attention to the comparative areas to be aimed at, and the

chances of being hit. The 3-decker presents an inflammable area, vulnerable to shot, of 10,150 square feet; the shield-ship, 3,750 square feet, both invulnerable to shot and uninflammable.

"It must be remembered that after the first two or three broadsides the ships become enveloped in smoke, little or nothing is seen beyond an occasional glimpse of a mast peering through the smoke, giving the low object then a great advantage over the high one. We know, also, that as the guns get hot the quoins are liable to fly out, or elevating screws run down, throwing the elevation out, and causing the shot to pass over the object. It may be asserted that one gun protected is equal to ten in the open, and a gun in the open is better than one badly protected by inflammable, splintering materials.

"Taking into consideration then all the above advantages, I believe I am within the mark when I state that one gun covered by a shield is equal to 10 guns in a 3-decker. This would give a ship with 20 guns in shields a destructive power equal to 200 broadside guns in a 3-decker; but, as the latter has only 60 broadside guns, the comparison will be as 200 to 60, or 10 to 3 in favour of the shield-ship. I have then shown that three of these shield-ships would be equal to ten 3-deckers."

There cannot be a doubt as to the immense advantage to be gained by adopting a strong, low hull, with plenty of power; it is what we have ourselves always advocated, and recent events have proved the value of such a system of construction beyond all question.

In "Spithead Forts," the author draws a striking comparison between what a stationary fort cannot do, and what iron cased war ships can, as antagonistic elements of actual warfare, we need not say, to the enormous advantage of the latter. Such a pro and con statement is now more than ever worthy of attentive perusal, coming, as it does, from a naval man who has devoted so many years of consideration to the subject. After what we have seen, and indeed now see, in every step in naval warfare, we cannot but entirely indorse his views and conclusions.

"Our National Defences," promulgates a plan which was originally laid before Government, with the usual fate of such productions, and it is now presented to the consideration of a larger jury; and his proposed arrangements are illustrated by a plan of Portsmouth Dock Yard and Spithead, showing how a flotilla of iron cased war steamers would work in combination with shore defences; and a railway map pointing out how a network of railways and telegraph stations would avail in throwing forces on any part of our coast, for the purpose of resisting all attempts at landing—men who do their work best, are generally far more envied for their opportunities, than commended for their industry and skill; but men of real genius make more opportunities than they find. May we not say that Captain Coles has succeeded in making his opportunities in the present instance, and hope that the chance will not be thrown away.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

IRON SHIELD SHIPS.

Sir,—This action between the ships of the Federal and Confederate States is a matter of the gravest import to this country, being actually worth more to us at this moment than all our committee labours and our costly and lengthened experiments at Shoeburyness put together. We find that the Confederate iron-plated steamer *Merrimac*, in commencing the action in sight of Fort Monroe with the Federal wooden frigates *Cumberland* and *Congress*, fired two guns at the former, and then struck her with her sharp bows, making a jagged hole in her side 7ft. in extent. "The *Cumberland* immediately began to sink, when the *Merrimac* backed a short distance and ran into her a second time, making a terrible hole in her, the water running into her at a furious rate, and finally sinking her." The *Merrimac* next turns her attentions to the *Congress*, and, in less than an hour, the latter strikes to her iron-sided adversary. The *Congress* had 50 killed, including three officers, 27 are reported wounded, and 40 prisoners. The *Cumberland* is reported to have had about 150 killed and wounded. The 100lb. shot of the *Cumberland*, and the shot from the batteries on shore are stated to have produced no effect on the *Merrimac*, and it is also said that the 180lb.-shot of the Federal shield-ship *Monitor*, which afterwards arrived at the scene of action, produced but little more effect on the *Merrimac's* iron sides than did the 100lb. shot of the *Cumberland*, and that it was demonstrated by the result of the fight that it was of little use to fire balls of less than 200lb. at her. The *Merrimac* continued her fire, assisted by two gunboats, up to the evening, now throwing shells into the Federal camp at Newport News, and engaging the *Minnesota* and other Federal vessels, the *St Lawrence, Roanoke*, and *Mystic* arriving during the afternoon, and proceeding up the James River. In the evening the Federal turret ship *Monitor*, Captain Ericsson's iron battery, arrived from New York, and next morning the two iron vessels engaged each other for two or three hours at long and short range without producing any perceptible effect upon each other, although the officers of the *Monitor* claim penetrating the sides of the *Merrimac* with three shots. Her hauling off from her action with the *Monitor* was most probably owing to her fuel or ammunition running short. The results of this action prove that iron-plated ships will not be destroyed so easily as many people may imagine when in action. It is here stated that anything less than 200-pounder shot is useless, even against the sides of the hurriedly constructed *Merrimac* of the Confederates. This, therefore, reduces the question of our future iron ships to one chiefly of ordnance, and in our future shield ships nothing of a less calibre than a 300-pounder should be mounted. A ship may carry 50 100-pounders and find herself unable to break an enemy's shell, but if she only carries six 300-pounders she also carries certain victory on her side and destruction to her opponent. The results of this action also furnish us with fearful proof of the helplessness of wooden ships when pitted against iron ones, and from the acknowledged panic in New York when the first news of the fight and the *Merrimac's* powers reached that city, we may be enabled to form some idea of the panic which would be felt in the city if one of these *Merrimacs*, or, worse still, "turretted" *Monitors*, were steaming about Spithead, unscathed by our fixed marine forts, and setting the dockyard on fire, while a similar monster was deliberately ascending the Thames for a purpose of his own. We in London should be quite as ready to sink hallast-laden ships athwart the bed of the Thames as the citizens of New York were to do the same thing in the channel inside Sandy Hook. No more forcible illustration could possibly have been given of the imperative necessity of having iron ships to meet iron ships, or of the folly of erecting isolated stone forts to contend with an adversary who, from the nature of his construction, is all but invulnerable to the largest shot, and has the important advantage of mobility in his favour. Our *Warriors* and *Defences* have cost immense sums, but they are not the description of ship required. We want shield ships. Five years since Captain Coles's models and drawings for this description of vessel were first made public, and illustrated by explanatory lectures delivered by Captain Coles at various times. The drawings for England's first ship are just completed, but the tenders for her construction are not yet closed; therefore, at this moment she exists but on paper. Look at our Transatlantic cousins. Their first shield ship, the *Monitor*, has just proved her capabilities and received her "baptism of fire" from the guns of an iron adversary, built from the results of our experiments on Jones's angulated target. With regard to the *Monitor*, it is no secret that her "turret," with its "turntable" and guns "placed parallel with each other, the direction of the tower directing the guns," as the *New York World* expresses it, is a copy, as near as our energetic brethren could get it, of Captain Coles's shield ship. Pray take up the question. Let us cease the mad folly of perpetuating all the errors of our present class of iron ships. Supposing the *Warrior* in a gale meeting an adversary with even one cupola, but that cupola carrying a 300-pounder gun. What must be the consequence? Why, the *Warrior*, unable to cast her guns adrift, would be smashed at her leisure by the one-gun ship. It is only by your taking the matter in hand that the construction of useless iron ships and of dockyards, that are to be "the wonders of the world," up long and tortuous rivers where no ship of any length or size will ever reach them (inaccessible alike to friend and enemy), will ever be put an end to. It would have been a far wiser plan to have fitted our *Royal Alfreds, Oaks*, and *Caledonias* as six-cupola shields ships, than to have made them useless 50-gun plated frigates. We have scarcely a line-of-battle ship or large frigate fit for sea service but what could be converted into a shield-ship, and the adoption of this plan, instead of perpetuating our present and acknowledged errors, would not only save millions to the country, but would give England an iron steam fleet worthy of the name.—I am, Sir, your most obedient servant,

W. L.

Portsmouth, April, 1862.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

April 3, 1862.—"On the Law of Expansion of Superheated Steam," by Mr W. Fairbairn. "On a new Method of Approximation applicable to Elliptic and Ultra-Elliptic functions; Second Memoir," by Mr C. W. Merrifield.

ROYAL INSTITUTION.

Jan. 31, 1862.—"On the Motion of Glaciers," by Mr W. Hopkins. "An Explanation of the Meteorogical Telegraphy and its Basis, now under trial at the Board of Trade," by Rear-Admiral Fitzroy.

INSTITUTION OF ENGINEERS IN SCOTLAND.

Feb. 19, 1862.—"On Veneer Cutting Machinery," by Mr J. Whitesmith.—"On Moveable Bridges," by Mr D. M'Coll.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

April, 10, 1862.—"On Single and Continuous Straight Girders," by Francis Campin, President.

After a few preliminary remarks upon the impulse given to bridge building, by the introduction of wrought iron as a material for that purpose, the author proposed to explain a simple and practical method of proportioning the flanges of straight girders. The amount of strain upon any part of a straight girder might be calculated to the greatest nicety by formula deduced from mathematical investigations, which, however, are generally too complicated to be practically available. The curve of strain upon a girder simply supported at each extremity is a paraholic segment, which, however, may be closely approximated by a circular segment, hence the least area of any section of the flanges may be measured on the ordinates of a curve, drawn as follows:—Find the area at the centre of the girder, from which point lay off to scale at right angles to the girder an ordinate representing such area, then describe a circle passing through the extremities of the ordinate, and line of girder.—It is desirable that the vertical scale of areas be as small as possible in proportion to the horizontal scale. The area of either flange at the centre, including loss by rivets, may be found from the expression

$$0{\cdot}0313 \frac{w\,l^2}{d}$$

where w = load in tons per foot run, l = space in feet, d = depth in feet, the result being the area in square inches.

The span of a continuous girder may be regarded as virtually divided into two or more parts, a central part acting as a girder supported at each end, and limited in length by the points of contraflexure, which part may be treated exactly as any ordinary single girder, as described above, and one or two end parts, of which each acts as a girder, fixed at one end, and free at the other, bearing an uniform load w per foot run distributed over its length, and a concentrated load at its extremity, equal to half the total load on the central part of the girder. The area at the point of fixture being found for either flange from the expression

$$\frac{W x}{8\,d}$$

where W = total load on half beam, and on central part, d = depth of girder, x = distance of point of contraflexure from point of support = length of half beam. All that remains to be determined is the value of x which corresponds to a minimum area of the curve of strain.

The author then explained the process of finding x which gives for a beam fixed at both ends,

$$0{\cdot}215\,l$$

and for a beam fixed above and supported at the other,

$$0{\cdot}25$$

In the case of a continuous girder the values of the x's are assumed first as equivalent to one of the above quantities, and then reduced to give an equality of area over the points of support, whichever span such area is calculated from. The author then proceeded to find the actual saving from the use of continuous girders, and from a calculation of numerous existent cases found that it sometimes amounted to 25 per cent. of the weight, averaging about 18 per cent.

These results were obtained from an empirical formula, for the weight of metal in a bridge, supposing single spans to be used; it is,

$$\frac{b\,l\,2{\cdot}25}{10{,}000}$$

giving the weight in tons, b = the breadth, and l = the space, both in feet, the quantity 2·25 being found from the expression

$$n = \frac{\log w - \log w^1 + \log b^1 - \log b}{\log l - \log l^1}$$

in which, w, b, l, w^1, b^1, l^1, are the weights, breadths, and spans for two cases. n = 2·25 was the mean result of a number of solutions of the above equations.

INSTITUTION OF NAVAL ARCHITECTS.

March, 27, 1862.—"The Council Report to the Members and Associates of the Institution."

After reading the report of the Council, in which the members and associates were congratulated upon the extraordinary success of the institution, the secretary, Mr E. J. Reed, announced that he had received a letter from the Hon. Captain Cochrane, in command of Her Majesty's steamer *Warrior*, accompanied by a chart or diagram of a perfectly novel kind, in which what might be called a complete scientific record of that vessel's voyage to Lisbon and Gibraltar and home again was set forth. Some idea of the value of this document and of the extraordinary knowledge and skill exhibited by Captain Cochrane in its composition may be gathered from the remarks with which the Secretary laid it before the institution. Mr Reed stated that the paper had been placed in his hands only a very few hours before the meeting assembled, and that he had consequently had no time to give it a detailed examination, or to extract from it those valuable facts which it manifestly contained; but he had found opportunity for examining it sufficiently to discover that it was by far the most perfect and important record of a steam voyage that had ever been brought to the notice of a scientific man. This statement was made not alone on account of the variety and exactness of the information which it afforded, but also because a very remarkable amount of scientific acumen and judgment had been brought to bear upon the methods of record which Captain Cochrane had introduced into it. The diagram consisted substantially of three sets of facts. First, those which related to the state of the wind and sea at every point of the ship's progress; secondly, those which concerned the ship herself, especially as regarded her behaviour: and, thirdly, those which depended upon the performance of the engines of the ship. Under the first head are recorded from hour to hour throughout the entire voyage the force of the wind, and its direction relatively to the ship's course, the atmospheric pressure indicated by the barometer, and the direction and amount of the sea's swell. Under the second head are given the draught of water, displacement, and midship section of the ship, the speed at which she went, the sail which she had set, and the duration and extent of her pitches, rolls, and lurches. Under the last head Captain Cochrane states the quantity of fuel consumed, the number of boilers at work, the grade of expansion to which the slide links were set, the actual indicated power given out by the engines, the number of revolutions made by the screw, the proportion of coal burnt per horse-power per hour; and the miles run per ton of coal under all circumstances. These various facts, which are of vital importance in a scientific point of view, and by no means unimportant in their bearing upon the economical working of our immense navy, are brought together in so ingenious and perfect a manner in Captain Cochrane's diagram, that all of them may be ascertained at a single glance for every hour throughout the entire voyage to Gibraltar and back. There can be no doubt, as the Secretary observed, that if the Admiralty could secure records like these from officers in command of our sea-going ships, and would liberally sanction, as they have done in this case, their communication to such professional persons as were then assembled, most valuable results would speedily follow. It may, perhaps be doubted whether some of our naval captains would be competent even to imitate the work which Captain Cochrane has so ably and laboriously initiated; but there are many by whom the task would be speedily mastered, and others would gradually fit themselves for it when they knew the Admiralty were anxious to see it done. It may be interesting to mention that, from Mr Reed's explanatory statement it appeared that the *Warrior* rolled or lurched worst on January 24, when entering the Bay of Biscay, where she met with exceedingly heavy rollers nearly a-beam, and a head sea. The greatest angle through which she lurched on that day was 39 deg., measured from the extremes. This was at 7 o'clock in the morning, and she continued to lurch through angles exceeding 30 deg. at intervals until 12 o'clock, the rolls being measured in all cases by a clinometer placed 20ft. 6in. before the foremost sternpost, and 3ft. 6in., below the upper deck. It was even stated by some on board that the ship inclined three several times on this 24th of January, through angles exceeding 39 deg.; but the correctness of the observations in these cases is doubted. On the homeward voyage no such extreme rolling was experienced, the greatest inclinations then attained being 17 deg. to port, and 6 to starboard on one occasion, and 10 to port and 15 to starboard on another. It should be observed, however, that the time of rolling, taking the worst days on the outward and homeward voyages respectively for comparison, did not vary greatly, the average oscillation being in the former case 6·5 per minute, and in the latter 6·25. The average number during the whole outward voyage was 6·; during the homeward, 4·77. The indicated horse-power developed by the engines of the *Warrior* on the trial trip at Portsmouth was 5,471·4, but the greatest ever developed during the trip to Gibraltar and back was but slightly over 3,000, and this was kept up for a very short period only, showing that on an experimental voyage it is not thought desirable even to approach the circumstances of a trial trip at the measured mile. It is highly satisfactory to learn, however, that, even when unassisted by her sails, the good ship several times approximated towards the speed produced at the measured mile, which was 14·35 knots. On leaving Lisbon for Gibraltar, for example, with all sails furled, she ran at more than 13 knots for nearly a day, and part of the time actually exceeded 14 knots. These are the kinds of facts with which Captain Cochrane's diagram abounds, and they are recorded, not loosely, or in a written report, but in a rigidly scientific form, and without colouring or modification of any kind. Both the officer who recorded them so carefully, and the Admiralty who permit their publication, certainly deserve great credit. It should be added that Captain Cochrane has appended to his diagram a track chart of the voyage, in order that the ship's position at any period of it may be known, and a figure showing the deviations which the ship's compass underwent as she proceeded to sea and back again. He even heeled the ship over when in port, in order to determine the effect which her inclination exerted upon the compass, so that no pains should be spared to make the record complete. It may not be out of place to state here that the Astronomer Royal has sent in to the Institution of Naval Architects to be read at one of the meetings, an important paper setting forth the manner in which the magnetic character of the iron employed in shipbuilding may be improved by certain modifications in the mode of rolling it. The compass question will at the same time be explained with regard to iron-cased ships, by Mr Archibald Smith, F.R.S., and Mr Evans, of the Admiralty, and with reference to merchant vessels by the secretary of the Liverpool Compass Committee. As the brief letter in which Captain Cochrane submitted his diagram to the institution contains an important and characteristic expres-

sion of opinion concerning the general qualities of the *Warrior*, we will add it here. It is addressed to the Secretary, and is as follows:—

"March 26.

"Sir,—I have the honour to state that the Lords Commissioners of the Admiralty have allowed me to forward to the Institution of Naval Architects the enclosed diagrams, which I hope may prove interesting, relative to the cruise of Her Majesty's ship *Warrior;* and I cannot refrain from taking this opportunity of mentioning that the *Warrior* behaved nobly in the severe gales and heavy sea she encountered, and that on her return to England she had sustained no damage, and was perfectly ready to proceed on active service to any part of the world. I have the honour to be, your obedient servant,

ARTHUR A. COCHRANE.

To E. J. Reed, Esq., Secretary, Institution of Naval Architects, &c."

Sir J. Parkinton read a letter, handed to him by a friend and written by Commander Tryon, of the *Warrior*, in which the ship is spoken of in the highest terms.

Sir J. C. D. Hay, M.P., chairman of the Iron Plate Committee, in the course of his remarks upon ship's armour, stated that the report of the committee was now in the printer's hands, but that no satisfactory conclusion had been reached as regarded the best mode of attaching the armour to the ship's sides. He stated, however, the committee were persuaded that what is called angulated sides possessed no real advantages as compared with the usual upright sides, when all the circumstances of the case were considered.

At the evening meeting of the institution, Mr John Laird, M.P., presided, and, after giving a general description of the *Merrimac* and *Monitor*, and exhibiting drawings of these vessels, he read an extract from a private letter which he had received from a reliable friend at New York, to the following effect:—

"The success of the Rodman gun has induced our Government to try experiments on a scale still larger, and they are about constructing guns of 20-inch bore, throwing shot of 1,000lb, which, it is thought, will crush in the side of any iron-plated ship, no matter what the thickness of the plates. The little *Monitor* iron-plated gunboat, with revolving tower, built by Ericsson, has proved a great success, and withstood a storm of shot and shell for six hours from guns of very heavy calibre. I am quite satisfied that gunboats will be of more service than large ships with iron sides. We are making rapid progress in building up a navy effective and not expensive. It is the intention to make our power on the ocean equal to that of any other nation, and then we are sure of peace from all parties."

The following papers were read:—

"The Rig and Sails of Steam Ships of War," by H. D. P. Cunningham, Esq., R.N., Assoc. "The Steering Qualities of Screw Steam Ships," by Capt. E. Pellew Halsted, R.N. "The Manufacture of Iron Plates," by Capt. J. Ford, O.N., Associate. "A proposed method of Forming and Attaching Ship's Armour," by J. Inman Fincham, Esq., Member of Council. "Iron Plank Armour for Iron Ships," by Charles W. Lancaster, Esq. "The Longitudinal Method of Constructing Iron Ships," by J. Scott Russell, Esq., F.R.S. "The Jointing and Riveting of Iron Ships," by J. Grantham, Esq. "The Preservation of the Bottoms of Iron Ships," by Charles W. Lancaster, Esq.

March, 28, 1862.—"The Rolling of Ships," by the Rev. J. Woolley, LL.D., F.R.A.S. "Mr Froude's Theory of Rolling," by James Crossland, Esq., M.I.N.A. "Measuring the Oscillations of Ships," by George Herbert, Esq. "The Propulsion of Steam Vessels, including a discussion of 'Slip,'" by J. Simon Holland, Esq. "The Mathematical Formulæ employed in the Computation, Reduction, and Discussion of the Deviations of the Compass, with some Practical Deductions therefrom as to the Mode of Construction of Iron-built Vessels," by Archibald Smith, Esq., M.A., F.R.S. "The Application of the Mathematical formulæ to the Deviations observed on board several Iron and Iron-Plated Ships," by F. J. O. Evans, Esq., R.N., Superintendent of Compass Department, Admiralty. "The Compass Equipment of Iron Ships," by W. W. Rundell, Esq., Secretary to the Liverpool Compass Committee.

March 29, 1862.—"The American Stevens' Steam Battery," by Norman S. Russell, Esq. "The Construction of Marine Steam Boilers," by Charles Wm. Williams, Esq. "The Ventilating Apparatus employed in the City of Dublin Company's Steamers," by Joseph Clark, Esq. "An Improved Method of Catting Anchors," by J. W. Hall, Esq., R.N. "Fixed Floating Vessels," by George Herbert. "Submarine Explosive Shells, and Vessels suited for their Employment," by Captain J. Harvey, R.N.

ROYAL SCOTTISH SOCIETY OF ARTS.

FEB. 24, 1862.—"On Coal Tar Colours, and their application to Textile Fabrics," by Dr Stevenson Macadam.—"On the recent frequent accidents from the use of Hydro Carbon Liquids," by Mr A. Bryson. He stated that the accidents which occurred from the explosion of paraffin and similar oils used for illuminating purposes were nearly all caused through the inflammability of the original oils being increased by large additions of such combustible liquids as naphtha, petroleum, &c. This mixture not only enhanced the inflammable qualities of the oil, but produced the exhalation from the liquid of a very explosive vapour, which immediately set fire to the oil on a light being applied. Mr Bryson condemned the practice adopted by some unscrupulous tradesmen of thus mixing paraffin oil with naphtha and petroleum, and selling it as pure and unadulterated. He illustrated his paper with experiments with paraffin oils of different quality—showing the explosive properties of the mixed oil, and the comparatively incombustible properties of oil purely prepared. The communication was remitted to a committee.

THE TIME-GUN.

The report of the committee on Mr Cumberland Hill's time-gun apparatus was read. It stated that the suggestion of the firing of a time-gun by the employment of an electro-magnet, whose armature would withdraw a detent, and allow a spring to drive a hammerhead forcibly on a percussion cap, was not new, and had been brought under the notice of the society by Mr Frederick Ritchie on the 25th April, 1859. Mr Hill, however, was entitled to orginality for his modification of the arrangement of the spring, whereby it was allowed to pull out the tongue of an ordinary artillery friction tube or fuse, instead of forcing down a hammerhead. The committee were of opinion (1) that the production of time signals by the employment of a galvanic current to force an electro-magnet, which in its turn directly liberated a spring, was uncertain in its results, and, when successful, entailed the use of comparatively large batteries, which cost much to procure, and were costly to keep in proper working order; and (2) that the introduction of Mr Jones' clock into the circuit, as practised at the Observatory on the Calton Hill, and the Castle, enabled the battery power and cost to be reduced to a minimum; whilst the certainty and accuracy of its action, and the consequent precision of the signalling, had not hitherto been equalled. In conclusion, the committee were of opinion that the gun apparatus proposed by Mr Hill would not be an improvement on the present system of firing the time-gun, the working gear of which it would be difficult to surpass for efficiency and accuracy.

DEC. 10, 1861.—"On the Concrete used in the late Extension of the London Docks," by Mr George Robertson, Engineer, New Works, Leith Docks.

METEOROLOGICAL SOCIETY.

JAN. 15, 1862.—"On the Pressure of the Wind in strong Winds and Gales at the Royal Observatory, Greenwich, in the Years 1841 to 1860," by J. Glaisher, Esq.

SCOTTISH SHIP-BUILDERS' ASSOCIATION.

MAR. 3, 1862.—"On the rig and equipment of Ships for War and Commerce," By Mr James Hall, Aberdeen.

April 7, 1862.—"On Steamship Economy," by Mr O. Hamerton.

GLASGOW ASSOCIATION OF ASSISTANT ENGINEERS.

MAR. 4, 1862.—"On Giffad's Injector," By Mr Primrose.

GEOLOGICAL SOCIETY OF DUBLIN.

Anniversary, 14th Feb., 1862.

PRESIDENT'S ADDRESS.—(*Continued from page* 23.)

An atmosphere of oxygen and water alone might create the most beautiful forms which delight the mineralogist; but unless carbonic acid and nitrogen were added, there could be no mineralogist to admire the beauty of the minerals; without carbonic acid, no vegetation could exist, and without nitrogen no animal could live.

Linnæus has defined the limits of the three kingdoms of nature in his "Fundamenta Botanica," chap. 1, aphorism 3:—"*Lapides* crescunt; *Vegetabilia* crescunt et vivunt: *Animalia* crescunt, vivunt, et sentiunt."

With equal propriety, and with a deeper meaning, we might say:—

Stones appropriate Oxygen and water;
Plants ,, Carbonic Acid, Oxygen, and Water;
Animals ,, Nitrogen, Carbonic Acid, Oxygen, and Water—
Man does all, and is conscious that he does so.

A consideration of the stratified rocks of the globe confirms the opinion, that carbon is to be regarded as a product of the atmosphere, like oxygen, nitrogen, and hydrogen, and not as a mineral. We are acquainted with but two important origins for carbon; viz., our coal-beds and limestones. The former of these are confessedly the result of vegetable organic life, and derive their origin from the vital power possessed by the Vegetable Kingdom, of obtaining carbonic acid from the atmosphere, fixing its carbon, and returning the oxygen to the air;—the latter source of carbon, limestone, owes its origin in great measure to the vital power possessed by Corals and other members of the Animal Kingdom, of fixing carbonate of lime in their skeletons, and so gradually laying the foundation for the formation of beds of limestone. But from what source was the carbonate of lime derived? Durocher's theory of the Basic Magma supplies us with silicate of lime and magnesia in abundance; and it is certain that the decomposition of the rocks derived from this layer of the earth, by the action of an atmosphere containing carbonic acid and water, would furnish in abundance the limestones and dolomites that abound in the later periods of the earth's history.

Our atmosphere contains at present in 100 parts,

Of oxygen,	20·61
" nitrogen,	76·95
" carbonic acid,	0·04
" water,	1·40
	100.00

In speculating on the primitive periods of the history of the globe, it is impossible not to believe that its atmosphere, containing as it did, in the form of carbonic acid, all the carbon now fixed in the earth as coal and limestone, must have had a composition widely different from that which now exists; and

that this difference in chemical composition must have had, as Brongniart thought, an important influence in producing that extraordinary development of vegetation of a peculiar kind which characterises the period of the formation of the coal-beds.

In confirmation of the preceding theory, I may remark, that the absence of limestone-beds in the older rocks has attracted the notice of almost every geologist, no matter in what country they have been studied. This paucity of limestone rocks is easily accounted for, by the consideration of the fact that the denudation and erosion of the outer layer of the globe could only supply materials for the formation of slates and sandstones, and that the limestones could not be formed until the eruption of portions of the second layer supplied the lime and magnesia requisite for their formation.

Read by the light of this theory, the stratified rocks of the globe appear to me to be capable of being grouped into a chronological order, as natural as that which prevailed among the primitive igneous rocks, in which the granitic preceded the trap rocks, and these latter the volcanic rocks, by laws resulting from the mechanical and chemical conditions under which they necessarily assumed their relative positions in the crust of the globe.

If the foregoing views respecting the arrangement of the layers of the earth, according to their chemical composition and consequent specific gravity, be considered probable, one effect of their adoption must be to destroy the positive value of such speculations as those of Mr Hopkins and Mr Hennessey as to the thickness of the supposed solid crust of the globe. These speculations are essentially founded on the hypothesis of Legendre and Laplace, that the specific gravities of the different layers of the globe depend only on the pressure to which they are subjected; and if the specific gravity should turn out to depend rather on the chemical composition of the layer than on its pressure, the law founded on the latter hypothesis would become worthless, and such speculations as I have alluded to, however ingenious as mathematical exercises, would cease to have a real value as applied to solve the problem of the thickness of the earth's crust.

I turn now, however, from this question, which appears to me impossible of solution, to the more important one of the Mineral and Chemical composition, and of the origin of granite, which is regarded on Durocher's hypothesis as the outer layer of the globe, or Acid Magma.

Before inquiring, however, into the origin of granite, it is necessary to inquire what granite is; and it is strange that, even on so elementary a question, there should be a difference of opinion.

If we ask the opinion of Bunsen, or, at least, of his followers, they will tell us that granite is a mixture of 10 parts of his Normal Trachytic Rock, with 2 parts of his Normal Pyroxenic Rock, which have the following compositions:—

	Normal Trachytic Rock.	Normal Pyroxenic Rock.
Silica,	76·67	48·47
Alumina, Iron (peroxide),	14·23	30·16
Lime,	1·44	11·87
Magnesia,	0·28	6·89
Potash,	3·20	0·65
Soda,	4·18	1·96
	100·00	100·00

If we consult English geologists, they will give us the unsatisfactory information, that granite is composed of quartz, feldspar, and mica, without stating what feldspar or what mica is included in the definition, and that if hornblende, appear instead of mica, the rock ceases to be a granite, and should be called a syenite.

And, finally, if we ask the opinion of the highest authority on this subject (Gustavus Rose), he has informed us that the presence of Oligoclase, as well as of Orthoclase, is requisite to constitute a true granite.—*Vid. Zeitschrift der Deutschen-Geologischen Gesellschaft*, vol. i. 1849.

Bunsen's definition of a granite is a mathematical fiction, the English definition has no precise meaning, and that of G. Rose is insufficient. Granite is not a mixture of two rocks; its minerals do not exclude Hornblende, nor do they necessarily include Oligoclase.

In Ireland, which is as rich a field for the study of the igneous rocks as England is for the study of the fossiliferous rocks, we have in Leinster a granite which contains quartz, orthoclase, margarodite, lepidomelane, and a periclinic paste, as its constituent minerals. In the Mourne mountains we have a granite containing quartz, orthoclase, albite, green mica, lepidomelane, and an undescribed paste; and in Donegal we find a granite containing quartz, orthoclase, oligoclase, margarodite, lepidomelane, and an unknown paste. These Irish granites are quinary, and even senary, in their composition, and are as truly granites as the pegmatite of Caernarvon, which is composed exclusively of quartz and orthoclase, and is binary in its composition.

What logicians would call the "essential difference" of granite appears to be "*a crystalline structure visible to the eye, and the presence of quartz and orthoclase.*"

Adopting this as our definition, granites may be classified as—

1. Binary, . . Quartz and orthoclase.
2. Ternary, . . Quartz, orthoclase, white mica.
3. Quaternary, . Quartz, orthoclase, white mica, black mica.
4. Quinary, . . *a.* Quartz, orthoclase, oligoclase, white mica, black mica.
   β. Quartz, orthoclase, oligoclase, black mica, hornblende.
   γ. Quartz, orthoclase, albite, black mica, horublende.

In this classification, the residual paste is omitted.

I have purposely omitted protogene from this classification of granites, as I believe no such rock as a granite composed of quartz, feldspar, and talc exists. It is said to abound in the Alps and Cornwall; in both which localities, I can assert, from personal observation, it does not occur. The following analyses of the so-called Protogene of Switzerland have been published:—

Protogene of the Alps.

	1	2	3	4	5	6	Mean.
Silica,	71·41	74·25	72·42	70·75	75·0(	72·96	72·80
Alumina,	14·45	11·58	14·53		12·9(	14·00	13·23
Iron (peroxide),	. .	*2·41		. .	1·1(	2·42	1·98
Iron (protoxide),	2·58	. . .	. .	. .	. . .	0·38	1·48
Manganese (protoxide),	. .	Trace.	. .	. .	. .	0·40	0·40
Lime,	2·49	1·08	1·03	1·08	1·26	1·12	1·34
Magnesia,	1·11		. .	. .		0·14	0·62
Potash,	2·77	10·01	. .	. .	9·34	4·47	3·62
Soda,	3·05		. .	. .		4·33	3·69
Water,	1·25	0·67	. .	0·71	0·40	. .	0·76
	99·11	100·00	. .	. .	100·00	100·22	99·92

* Iron in excess in this analysis, owing to trituration in an iron mortar.

MONTHLY NOTES.

MARINE MEMORANDA.

Yacht building on the Clyde looks very promising this season. Mr Fyfe, the well-known builder of this class of craft, has no fewer than five yachts on the stocks, a cutter of 90 tons for Charles Tennant, Esq.; a cutter of 25 tons for A. S. Finlay, Esq., of Castle Toward; a schooner of 40 tons for Ireland; a cutter of 15 tons, and one of smaller size. Messrs Wingate, Whiteinch, are building an iron cutter of about 80 tons for Ireland, and a gentleman resident at Dunoon has ordered the construction of a large iron schooner by a Clyde firm. Mr Richardson's beautiful schooner *Circe* is nearly ready for launching by Messrs Roht. Steele & Co. It is a curious fact as denoting what great changes have recently taken place by reason of the internal war in America, that our steam marine is now being largely employed in the exclusive conveyance of cotton from this country, to New York, as the war in the South prevents the obtainment of the usual supplies from a direct source. Of four steamers laden entirely with cotton at Liverpool, three have arrived at New York, increasing the stock of cotton at that port by about 3500 bales. These are the Liverpool, New York, and Philadelphia Company's steamship *Glasgow;* the screw steamship *Hope*, formerly on the Mediterranean station; and the Clyde screw steamship *John Bell*, Glasgow and New York line, specially chartered. Several of the Cunard mail and Inman's weekly steamers also carried cotton to New York at very high freights.

The *Scotia*, iron paddle wheel steamer, built for the Cunard line by Messrs Napier, on the Clyde, made her first run from the Cloch lighthouse on the Clyde, to the Bell Buoy at the month of the Mersey, in 12 hours and 4 minutes. At her trial between the Cloch and Cumbrae lights, she attained a speed of 17·6 miles per hour, and a speed of 19 miles is anticipated. The *Scotia* is by far the largest vessel belonging to the Atlantic service, and she will be commanded by the senior captain of the fleet, Captain Judkins, who leaves the *Persia* for her.

The Warrior and Black Prince.—The reduction in the head of spars of these vessels of war is ordered to be carried out according to the following scale:—Bowsprits—To be reduced from 49 feet length and 40 inches diameter to 25 feet in length and 24 inches diameter. Jibbooms—To be reduced from 49 feet length and 16 inches diameter to 42 feet length and 13½ inches diameter, Flying Jibbooms—To be reduced from 52 feet length and 8½ inches diameter to 44 9-12 feet length and 7½ inches diameter. Both ships are being fitted with a second pair of cat, or fish heads, by which the anchor will be carried some 20 feet further aft than is the case at present. Those for the *Black Prince* are on the point of completion in the blacksmith's shop of Portsmouth Dockyard, and are two fine specimens of smith's work. Each cathead weighs 45 cwt.; the length is 15 feet; width at top of sheave-holes, 14 inches; at bottom of riveting to ship's side, 21½ inches; breadth of side-plates at widest part 26 inches, and ⅝ inch thick; thickness of outside plates for sheave-holes, 1¼ inch; angle iron for framing, 4 inches by ⅝ inch thick; angle iron to form connection with side of the ship 5 inches by ⅝ inch thick; diameter of rivets, 15-16 inch; distances apart of rivet holes, measuring from centre to centre, 4½ inches. They have been made under the superintendence of Mr Wells, the master smith of the dockyard, and their manufacture reflects great credit upon him for the skill and neatness with which they have been put together. The *Black Prince* is ordered to be fitted with an auxiliary boiler to work the auxiliary engine, without interfering in any way with the main boilers attached to the ship's engines. This auxiliary boiler will supply steam to the engine for working the steam capstan and fire-engines, yard whips, &c. It will be fixed in the fore-part of the engine-room on the starboard side. The ship will be undocked in about a fortnight, and taken out to Spithead to test her enlarged rudder under steam. Should it be found to answer as it is expected to do, the temporary wooden casing with which it is now fitted will be replaced by iron plating.

The 30th of April was the time originally named for the *Black Prince* to he out of the hands of the dockyard, hut it is now proposed to extend this time until the same date in June. The *Hector*, 32, iron frigate, of 4,063 tons and 800 horse-power, building at Glasgow, when launched is orderecl to be taken round to Portsmouth, where the following armament will be prepared for her:—Main Deck.—24 68 pounder smooth bore guns of 95 cwt. each, and 6 100-pounder Armstrongs of 82 cwt. each, all on rear chock carriages with directing bars. For Boats.—Two 20-pounder Armstrongs of 13 cwt. each, and one 9-pounder Armstrong of 6 cwt. Field guns—one 12-pounder Armstrong of 8 cwt.; one 6-pounder smooth bore for short practice, with elevating carriage; and one field carriage and limber to carry a 20-pounder Armstrong. It will be observed that while no mention is made of guns for the upper deck, six 100-pounder Armstrongs are fixed as part complement for the main deck, notwithstanding that past experience proves that Armstrong guns, from their breaking of breech pieces, and consequent escape of gases and explosions ahaft are unsuited for a ship's main deck. In fact, a strong feeling exists among naval officers that the Armstrong guns, with their present complication of parts behind the chambers and the present imperfect mode of closing the breecb, are unsuited for naval service, except when placed on a ship's upper deck, where they may be useful for purposes of cbase, or throwing a projectile a long distance, and where, should an explosion take place, the broken hreech and gases may escape into the air overhead, and thus lessen the chauce of injuring the gun's crew. So far is this feeling acknowledged that provision is heing made in the drawings for the shields of Capt. Coles' ship for the substitution of the 95 cwt. smooth-bore gun for the 100-pounder Armstrong, should the closing of the breech of the latter continue in the same uncertain state as it is at present.

The Phœbe.—A fourth and final trial of the machinery of the screw steam frigate *Phœbe*, 51, recently took place outside Plymouth Breakwater, under the supervision of Capt. Key, Mr Steil, of the Indus, and Mr Ward, assist.-engineer from Keyham Steamyard. At the previous trials it was found that a great strain existed at the valve, through which a proper equilibrium did not prevail. This defect was attributed to the fact that the cylinder faces were of hrass. A ring was, in consequence, introduced on the back of the valve with springs attached to it, and a complete equilihrium has been thus obtained. There was a fine breeze from the south-east, and the *Phœbe* was taken round the Eddystone lighthouse for the purpose of ascertaining if the machinery was in proper condition for active service. The engines, direct air-pump, are by Messrs R. Napier and Sons, of Glasgow, who were represented hy Mr Brown. They are of 500-horse power nominal; diameter of cylinder, 65 inches; and length of stroke, 3 feet 6 inches. The length of the shaft is 96 feet; diameter 12 inches. The diameter of screw, Griffith's, is 18 feet; pitch, 22 feet; and length, 3 fect. The engines were worked on Monday up to an indicated power of 1900 horses; revolutions, 61 per minute; pressure per square inch, 20lb; and vacuum, 25½ inches. The results appeared to obtain the approbation of the inspectors, who were also well satisfied with the ventilation of the engineers' department throughout. The temperature was tested on three several occasions, which produced an average in the engine-room of 64 deg.; in the stoke-hole aft, 81; amidships, 87; and forward, 91; On deck the temperature was 52 throughout.

MISCELLANEOUS.

"Pedigree" Wheat Growing.—The conviction that a good "pedigree" is as valuable for working use in plants as in animals, and that the careful rearing of the seed which possesses this necessary qualification, will furnish the means of wonderfully increasing our cereal produce—has induced Mr Hallett of the Manor House, Brighton, to study the matter in the most careful manner, and the results of his twelve years' attention are now before us Mr Hallett commenced his actual practice in 1857, with "Red Nursery Wheat," taking two of the finest ears he could find in a field of that grain. These ears contained 87 grains, and that quantity was planted in the middle of December, 1857, in single grains, six inches apart every way. One of these grains alone, produced ten ears, containing in the aggregate 688 grains. This produce was made the subject of his experiment next year—on the presumption—now well founded—that the superior production, was the consequence of greater prolific power. In 1859 one single grain of these ten ears produced seventeen ears, containing 1,190 grains, with an average as before, of 70 grains to the ear. On the 19th of September, 1859, he planted the seed from these seventeen ears, and from one grain, taken from the largest, he gathered, in 1860, 39 ears, containing 2,145 grains; one of which, in 1861, produced *fifty-two* ears; that, at 70 grains per ear as before, gives 3,640 grains. The ear from which this grain was taken measured 8¾ inches, and contained 123 grains. The experiment therefore shows a progressive increase, as exhibited in the following tabular view:—

		Length.	Contents.	Ears on Finest Stool.
		Inches.	Grains.	
1857	Original Ear	4⅜	47	—
1858	Finest ditto	6¼	79	10
1859	Ditto ditto	7¾	91	22
1860	Ears imperfect from the wet season	—	—	39
1861	Finest Ear	8¾	123	52

This shows what may be done hy repeated "selection" year after year. By carefully picking out the finest ears, each successive season, Mr Hallett has more than doubled the size of the original ears. In fact, those we have seen are perfect monster ears. From small beginnings, this system of growing, has now reached farm-like proportions, and Mr Hallett has now thirty acres under seed, according to his system, for the 1862 crop. The great object of dibbling the grain, with which system of planting he began, was to insure perfect singleness and regularity of plant. But he now uses the turnip cups of the drill, only just large enough to contain one grain at a time, thus delivering a stream of single grains. In this way he secures all the advantages of dibbling in combination with the increased speed of the drilling process. The selected pedegree wheat is being tried this year all over the country by experienced farmers, so that the 1862 crop will settle to a certainty, what may really be expected from duly following out the new plan.

Life Boat Expenses.—We have been furnished by Mr. R. Lewis, Secy., with the following statement. During the past two years, (1860-61), the National Life Boat Institution has incurred expenses amounting to £22,650 on various Life Boat Establishments on the Coasts of England, Scotland, and Ireland. In the same period the life-boats of the Institution have been instrumental in rescuing 500 persons from different shipwrecks on the Coasts of the United Kingdom. For these and other life-boat services, the Institution has voted £1,893 as rewards to the crews of the life boats. It has also granted rewards amounting to £515 10s for saving 373 shipwrecked persons by shore-boats and other means, making a total of 871 persons saved from a watery grave during the last two years. The number of lives saved by the life-hoats of the Society, and other means since its formation, is 12,293, for which services 82 Gold Medals, 704 Silver Medals, and £15,250 in cash, have been paid in rewards. The Institution has also expended £57,200 on life-boats, life-boat transporting-carriages, and boat-houses.

Professor Barlow, F.R.S.—Mathematical science has just sustained a severe loss in the death of Professor Barlow, than whom, perhaps no one has contributed more to the literature of the applied sciences of our times. This distinguished man was born in Norwich in 1776, and he displayed his mathematical prowess and great energy of character at a very early age. In 1806 he was appointed one of the mathematical professors at the Royal Military Academy at Woolwich, which office he held until 1847. He was the author of numerous works, among which are his well-known treatises on the "Theory of Numbers," the "Strength of Materials," his "Essay on Magnetism," &c. His discovery of the means of correcting the local attraction on the compasses of ships hrought him into great notoriety, and he received the Copley medal, and was elected on the council of the Royal Society. The Board of Longitude conferred upon him the reward provided for useful nautical discoveries. The Emperor of Russia acknowledged the value of the invention, and presented him with the diploma of the Imperial Academy of Sciences at St. Petersburg, and he was elected a corresponding member of the Institute of France and Royal Society of Brussels, besides other rewards and honours. In mechanical subjects he was associated with Mr Telford in experiments for the Menai Bridge. He was then called in reference to the removal of old London Bridge. In 1836 he was appointed one of the Irish railway commissioners, with General Sir John Burgoyne and the late Mr Drummond, and subsequently appointed on three other Royal commissions relating to railways in England. In 1847 he retired from the Royal Military Academy, and the Government awarded him his full income for the remainder of his life, in consideration of his eminent services. Enjoying the highest respect and admiration for his learning, and the way in which he used it during his long and active life, his memory well deserves some tribute from us now that he is dead.

The Channel Railway.—The scheme proposed by Mr J. Chalmers for uniting the English and French railways by means of a submarine railway has been submitted to the directors of some of the principal railway companies in England, with a view to the appointment of a committee of railway men to inquire into the whole scheme, and to report thereon as to its practicability and utility. He proposes, as we have already informed the readers of the *Practical Mechanic's Journal*, in a recent article upon the scheme, to cross the English Channel by a submarine railway, enclosed in iron tubes, extending from a point about two miles to the east of Dover to a point on the French coast about seven miles to the west of Calais, the line heing about 20 miles in length. The deptb of water in the central portion of the Channel is about 168 ft., gradually diminishing towards the English and French shores. It is proposed to construct a double line of railway through a continuous series of wrought-iron tubes, each 400ft. in length and 30ft. in diameter, braced and strengthened in a peculiar way, having water-tight joints. The wrought-iron tuhe, when completed, is intended to pass along the bottom of the Channel, the shore ends of it being carried for some distance under the beach, and continued iuland by means of tunnels having rising gradients to meet the level of railways in England and France. It is stated that the gradients would not exceed 11ft. per mile, which would practically be as good as level. A large ventilating sbaft and lighthouse constructed of iron and stone is proposed to be fixed in the centre of the Channel through which the main tuhe is intended to pass; other ventilators near the shore ends would be erected if necessary, and be provided with lightbouse apparatus. Mr Chalmers proposes that the laying of the tubes shall commence in both directions from the large ventilating shaft in mid-channel, and by means of certain appliances to perform the difficult operation of fixing the tubes in their proper positions and connecting them together. Wrought-iron boxes or collars filled with stones on each side of tbe tubes are intended to keep them down on the hottom of the Channel; In addition to which a quantity of stones or chalk is to be thrown from vessels over tbe tubes so as to form a kind of ridge across the hottom of the Channel about 40ft. in height and 140ft. wide at the base, enclosing the tuhe and leaving the depth at low water over it to range from 40 to 120 feet. Mr Chalmers appears to have given a great deal of consideration to the subject, is confident of the practicability of completing the undertaking in three years, and taking passengers from London to Paris without cbange of carriage in seven or eight bours. He estimates the total cost, including four miles of tunnel approaches, at £12,000,000, or £500,000 per mile, for a double line of Railway; that the traffic or toll, would yield £1,300,000 a year, or 10 per cent. on the outlay, heing about £52,000 per mile per annum, or about £1000 per mile per week.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING APRIL 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	d.	£	s	n	£	s.	d.	£	s.	d.
Bars, &c., British, per ton,	5	15	0	5	15	0	5	15	0	5	15	0
Nail Rods,	7	0	0	7	0	0	7	0	0	7	0	0
Hoop,	8	0	0	8	0	0	8	0	0	8	5	0
Sheets,	8	10	0	8	10	0	8	5	0	8	5	0
Pig, No 1, Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	10	0	7	0	0	7	0	0
Rails,	5	7	6	5	7	6	5	7	6	5	7	6
Pig, No. 1, Clyde,	2	10	0	2	12	0	2	18	0	2	18	0
Swedish in bond,	11	15	0	12	0	0	11	5	0	11	10	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	10	0
In faggots,	17	10	0	17	10	0	18	0	0	17	10	0
SPELTER, ingot,	17	15	0	17	15	0	18	0	0	18	10	0
ZINC, sheet,	23	0	0	23	0	0	23	0	0	23	0	0
COPPER.												
Sheathing bolts, pr lb.,	0	0	11	0	0	11	0	0	11	0	0	11
Bottoms,	0	1	0½	0	1	0½	0	1	0	0	1	0
Old,	0	0	9¼	0	0	9	0	0	9	0	0	9½
Tough Cake, per ton,	98	0	0	98	0	0	98	0	0	98	0	0
Tile,	98	19	0	98	0	0	98	0	0	98	0	0
TIN.												
English blocks, per ton, duty free,	120	0	0	120	0	0	120	0	0	120	0	0
Bars in barrels,	121	0	0	121	0	0	121	0	0	121	0	0
Refined,	122	0	0	122	0	0	122	0	0	122	0	0
Banca, in bond,	125	0	0	125	0	0	124	0	0	123	0	0
Straits, ditto,	117	0	0	117	0	0	117	0	0	115	0	0
TIN PLATES.												
Char IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	0	1	2	0	1	2	6	1	2	6
LEAD.												
English pig,	19	15	0	20	0	0	20	0	0	19	15	0
Sheet,	21	0	0	21	0	0	20	10	0	21	0	0
Spanish pig, in bond,	19	0	0	19	10	0	19	10	0	19	0	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	16	0	0
Quebec, red pine,	3	5	0	4	0	0	4	0	0	0	0	0
" yellow pine,	3	0	0	3	0	0	3	5	0	3	10	0
St. John, N.B., yellow,	5	0	0	5	0	0	5	0	0	5	5	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	0	0
" Birch,	4	10	0	4	10	0	4	10	0	4	10	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	5	0	4	0	0	4	5	0	4	5	0
Memel fir,	3	10	0	4	0	0	4	0	0	4	0	0
Riga,	3	15	0	3	10	0	3	10	0	3	15	0
Swedish,	2	15	0	3	0	0	3	0	0	3	0	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	0	0	16	0	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	10	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	10	0
Archangel yellow,	14	0	0	14	0	0	14	10	0	14	10	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	10	0	9	10	0
Memel,	12	0	0	12	0	0	12	0	0	12	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	0	0	11	0	0
" white,	9	10	0	9	10	0	10	0	0	10	0	0
Gefle, yellow,	12	0	0	11	0	0	11	0	0	11	0	0
Soderhamn,	11	0	0	11	0	0	11	0	0	11	0	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	0	0	23	0	0	23	0	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	22	10	0	22	10	0	22	0	0	22	0	0
White Lead,	26	10	0	26	10	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	41	0	0	41	0	0	41	0	0	41	0	0
" yellow,	34	0	0	35	0	0	34	0	0	36	0	0
Sperm,	93	0	0	92	10	0	92	10	0	93	0	0
Cod,	39	10	0	39	10	0	39	0	0	39	0	0
South Sea,	36	0	0	36	0	0	36	0	0	36	10	0
Olive, Gallipoli, per tun,	56	10	0	57	0	0	57	6	0	57	0	0
Palm, per tun,	43	0	0	43	10	0	43	0	0	43	10	0
Cocoa-nut,	49	10	0	50	10	0	50	0	0	50	0	0
Rape pale foreign,	49	8	0	49	10	0	49	0	0	49	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	34	10	0	34	0	0	34	0	0
Jute,	14	0	0	13	10	0	14	10	0	14	10	0
Hemp Rope,	24	10	0	24	0	0	24	0	0	24	5	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

17th February, 1862.

421. John Whitaker, Leigb, Lancashire—Pulping roots.
422. James J. Van den Berg, Hague, Netherlands—Fire kindler.
423. Edward T. Hughes, Chancery Lane—Collecting gases.—A communication.
424. Thomas Birdsall and James Birdsall, Leeds—Tanning.
425. James Combe, Belfast—Machinery for winding cops, and in the treatment of cops for warps and other purposes.

18th February, 1862.

426. Henry E. Quant and George H. Fisk, High Street, Manchester, and William Dawes, Bolton, Lancasbire—Crinolines.
427. John H. Hastings and James Freezer, Holkham, and John Woods, junior, Wells, Norfolkshire—Ploughs.
428. Richard Watkins, Lower Belgrave Place, Pimlico—Light in lamps.
429. Charles D. Segoffin, Paris—Apparatus for looking at photographic cards.
430. John Lees, Rookery, Yorkshire—Improved trap.
431. William Clark, Chancery Lane—Lighting cigars.—A communication.
432. Michael Henry, Fleet Street Cartridges.—A communication.
433. William Bush, Tower Hill, Middlesex—Omnibuses and carriages.
434. William Firth, Burley, Leeds—Digging.

19th February, 1862

435. Charles T. Marzetti and John Watson, Minories, E.C.—Raising or lowering heavy bodies.
436. John T. Pendlebury, Elton, and George Pendlebury, Tottington-lower-end, Lancashire—Doubling or plaiting cloth.
437. Henry B. Barlow, Manchester—Carding fibrous materials.—A communication.
438. James Nasmyth, Brussels, Belgium—Motive power.
439. Frederic Barnett, Oxford Street—Lamp or lantern.
440. William B. Adams, Hampstead, Middlesex—Springs.
441. Nathaniel Symons, Cambridge Street—Steam engines, also, wheels and paddle wheels.
442 James Turner, Upper Thames Street—Mixing, mincing, and pounding.
443. William Hinton, Greville Street, Holborn—Barometers.
444. William Davis, Spencer Road, Stoke Newington—Gases.
445. James Paterson, Middle Temple, Middlesex—Re-burning animal charcoal.—A communication.
446. Joseph Gregory, Wellington, Somersetshire—Candlesticks.
447. George T. Bousfield, Brixton, Surrey—Iron boilers, tanks, and vats.—A communication.
448. James Wilcox, Ludgate Hill—Frills or ruffles.—A communication.

20th February, 1862.

449. George F. Lee, New Bridge Street—Tourniquets.—A communication.
450. Joseph Friedlaender, Antrim, Ireland—Flax, hemp, and jute.
451. Emil M. Stochr, Manchester—Manganese.—A communication.
452. David Wilkie, Great Hermitage Street—Ship's compass.
453. Joseph Bleasdale and Frederick W. Borland, Accrington, Lancashire—Fluted rollers.
454. Robert T. Pritchett, Saint James' Street—Targets or butts.
455. James Paterson, Middle Temple, Middlesex—Animal charcoal.—A communication.
456. James Paterson, Middle Temple, Middlesex—Evaporation of saccharine solutions.—A communication.
457. Charles Wood, Bramford, Suffolk—Horse rakes.
458. Lord A. S. Churchill, Rutland Gate, Hyde Park—Electric telegraphs.

21st February, 1862.

459. James Spence, Liverpool—Transbipping grain, salt, &c.
460. Richard H. Skellern, Hatcham Park, Surrey—Self-inking hand stamp.
461. Henry Ward, Castle Bromwich, Warwickshire—Ladies' saddles.
462. John Standish and John Gooden, Egerton, Lancashire—Carding engines.
463. William Hamer, Little Lever, Lancashire—Preparation of fibrous materials.
464. Edward S. Crease, Gracechurch Street—Excavating rock or other earthy substances.
465. Robert Pickin and William E. Pickin, Birmingham—Carriage bodies.
466. Joseph Krasuski, Paris—Mastering fiery horses.
467. William M'Adam and William Chrystal, Glasgow—Sheaves or pulleys, journals, bushes, and other bearing or rubbing surfaces.
468. Spencer Smith, Higb Holborn—Magnetic engines.

22d February, 1862.

469. Horace Chavasse, Timothy Morris, and George B. Haines, Birmingham—Metallic bedsteads.
470. William Ashtou, Manchester—Braids and similar articles.
471. William H. Ross, Liverpool—Sugar.—A communication.
472. James Kirkwood, Paisley, Renfrewsbire—Looms.
473. Augustus Bornemann, Monmouth Street, Bath—Fountains.
474. John Millington, Oaken Gates, Salop—Hearse or bier.
475. George T Bousfield, Brixton, Surrey—Elevating hay, straw, and earth.—A communication.
476. Charles H. J. W. M. Liebmann, Huddersfield, Yorkshire—Felted fabrics.
477. James Townend, Bradford, Yorkshire—Jacquard engines.
478. James P. D. Camp, Fleet Street—Valves.—A communication
479. David B. White, Newcastle-upon-Tyne—Protecting liquids.
480. George Blakey, Samuel Blakey, and Johu Blakey, Liverpool, and Benjamin White, Birkenhead, Cheshire—Leggings or gaiters.
481. George J. Oram, Wilmingtou Square, Middlesex—Watches and lockets.
482. Robert Foster, Beeston, Nottingham—Buildings or erections.
483. William B. Johuson, Manchester—Steam engines.
484. Marc A. F. Mennons, Paris—Burners for heating by gas.—A communication.

24th February, 1862

485. William Johnston, Glasgow—Gas and other lamps.
486. George West, Long Lane, Borough, Surrey—Washing machines.
487. John Cunningham and Robert Cunniugham, Paisley, Renfrewshire—Ornamental fabric, and improvements in weaving and in jacquard apparatus.
488. John C. Haddan, Bessborough, Pimlico—Small arms, artillery, and projectiles.
489. Richard Waller, Baker Street, Middlesex—Boots and shoes.

490. Thomas Blair, Carlisle—Breaking lump sugar.
491. William Clark, Chancery Lane—Supplying boilers with water.—A communication.
492. Thomas N. Kirkham, West Brompton, and Vernon F. Eusom, Highgate—Bleaching and dyeing.
493. Percy G. B Westmacott', Nowcastle-upon-Tyne—Armour plating.
494. Thomas Partridge, Tenby Street, Birmingham—Printing railway tickets.
495. Lewis Davis, Gloucester Gardens, Hyde Park, and Frederick M. Parkes, Marylebone Road—Gas.
496. Richard A. Brooman, Fleet Street—Reaping machines.—A communication.
497. Frederick St. G. Smith, Drogheda, Ireland—Grinding quartz, bones, grain, &c.
498. William E. Newton, Chancery Lane—Joints or chairs.—A communication.

25th February, 1862.

499. John Carnaby, Skinner Street—Taps and valves of gas pipes.
500. Jeremiah Woodrow, Oldham, Lancashire—Hats.
501. David Wilkie, Great Hermitage Street—Coating the bottoms of sailing vessels.
502. John Piddington, Gracechurch Street—Shelling or husking grain.—A communication.
503. John Piddington, Gracechurch Street—Condensing apparatus.—A communication.
504. Edwin Bliss, Percival Street, Clerkenwell, and Henry Lamplough, Holborn Hill—Viewing microscopic photographs.
505. William Clark, Chancery Lane—Tobacco pipes.—A communication.
506. Thomas Watson and Robert Dracup, Thornton, Yorkshire—Combing wool and other fibres
507. Carlo Minasi, Saint James's Terrace, Kentish Town Road—Cartridges and fire-arms.
508. Charles W. Heckethorn, Saint Ann's Road, Brixton—Motive power.
509. John Imray, Westminster Bridge Road, Lambeth—Hinges.
510. Joseph Whitworth, Manchester—Projectiles.
511. William M'I. Cranston, King William Street—Reaping and mowing.
512. Courtenay Kingsford, Fenchurch Street—Bread.
513. Pierre J. Guyet, Paris—Coupling pipes.
514. Harry W. Cook, Manchester—Propelling by electricity.

25th February, 1862.

515. John Boocock and Thomas Daveuport, Bury, Lancashire—Spinning fibrous materials.
516. Alfred Green, Forest Hill, Lewisham—Bordering envelopes.
517. Alexander Stephen, Glasgow—Ships or vessels
518. George Davis, Serle Street, Middlesex—Careening docks.—A communication.
519. George Rees, Goswell Road, Clerkenwell—Marine sub-ways.
520. Agathe D. Duparet, Paris—Ornamentation of tissues.
521. Jacques Dothee, Paris—Colouring horse-hair tresses, hats, or ornaments.
522. James H. Bennett, Blackburn, Lancashire—Steam generators and atmospheric engines.
523. Thomas King and Robert Varvill, Liverpool—Flow of fluids.
524. John Cliff, Lambeth, Surrey—Glazing stoneware.
525. William Miller, Blackfriars, Surrey—Sugar.
526. Charles L Knoll, Tottenham Court Road—Pianofortes.
527. William Clark, Chancery Lane—Clasps or fastenings of jewellery.—A communication.
528. Edwin G Bruzaud, Pembroke Road, Kensington—Pianofortes.
529. William P. Savage, Roxham, Norfolkshire—Fire-arms.
530. John Medhurst, Lower Queen Street, Rotherhithe—Reefing and furling sails.
531. John Smith, Coven, Wolverhampton—Drying grain.

27th February, 1862.

532. George Torr, Bucks Row, Whitechapel—Reburning animal charcoal.
533. Thomas Adams, Deptford, Kent—Steam pressure valves.
534. Charles Clark, City Road—Tea and other trays.
535. William A Gilbee, South Street, Finshury—Fire grates for boilers.—A communication.
536. William Smith, Salisbury Street, Adelphi—Cigaretts.—A communication.
537. James Taugye, Birmingham—Hydraulic lifting jacks
538. Sir Charles T. Bright, Victoria Street, Westminster—Electric telegraphs.
539. Thomas Bray, Dewsbury, Yorkshire—Ornamenting wood.
540. Robert Seager, Ipswich—Boots and shoes.
541. John R Foster, Wiusley Street, Middlesex—Bullion fringe or cord.
542. William S. Wood, Leeds, Yorkshire—Valves.
543 Joseph Revel, Dukinfield Cheshire—Oil cans.

28th February, 1862.

544. P. D. Azemar, Paris—Watches.
545. W. H. Muntz, Millbrook Lodge, Hants—Paddle wheels.
546. A. W. Makiuson, Westminster, and W. F. Batho, Birmingham—Engines.
547. J. C. Ratliff, Coventry—Binding books.
548 G. M'Kenzie, W. F. Murray, and J. Hamilton, Glasgow—Bobbins.
549. John Pollock, Bridge Row—Protecting trousers.
550. J. L. Charcouchet, Lyons, France—Breaking stone.
551. R. A. Brooman, Fleet Street—Hats and bonnets.—A communication.
552. James Parker, Camberwell—Motive power.

1st March, 1862.

553. Thomas Cowburn, Manchester—Soap.
554. Thomas Bradford, Manchester—Washing machinos.
555. James Sim, Aberdeen—Gas meters.
556. H. C. Muller, Middlesex—Bear skin caps.
557. Matthew Dodds, Hamsterley—Moulding.
558. P. H. Boyer, Paris—Boots and shoes.
559. P. J. Guyet, Paris—Taps or valves.
560. Maurice and Arnold Gabriel, Ludgate Hill—Artificial teeth.
561. Sam Hague, Nottingham—Hammers.
562. A. E. Ragon, Bernard Street—Electric alarums.—A communication.
563. Andrew Potts, Cappagh, Ireland—Flax and hemp.
564. Palrick Robertson, Cornhill—Yeast and ammoniacal salts.
565. S. G. Reynolds. Bristol—Spading machines.
566. J. G. Jennings, Holland Street—Chimneys or flues.
567. J. B. Kendall, Boston, U.S,—Horse shoe.
568. Louis Martin, Tenison Street, and Oliver Penfold, Drury Lane—Candle lamp.
569. Cornelius Boolds, Kennington Park—Fastenings for gloves
570. J. W. Davis and Francis Davis, Hull—Supplying water to boilers.
571. Henry Bowen, Cardiff—Gas meters.

3d March, 1862.

572. Robert Shaw, jun., Portlaw, Ireland—Charging fire-arms.
573. Pierre Remond, Paris—Bridle bits.
574. Thomas Bell, Wishaw, Lanarkshire—Distilling bituminous minerals.
575. Abraham Sheldon, Tipton, and James Sheldon, West Bromwich—Smelting furnaces.
576. Joseph Schofield, Huddersfield—Looms.
577. Andrew Tevendale, Liverpool—Gas
578. Thomas Tillam, Church Street, Deptford Green—Purifying gas.
579. Alfred Bedborough, Southampton—Letter boxes and bags.
580. J. B. A. Quiquandon. Paris—Jacquard machines.
581. Gustav Bischof, jun., Swansea—Treating ores.
582. William Conisbee, Waterloo Road—Colour printing machines.
583. Henry Bunning, New Cross, Deptford—Lubricating grease.
584. F. B. Houghton, Kensington—Paper.

4th March, 1862.

585. John Gjers, Middlesbrough—Moulds
586. James Ellis, Petersham. Surrey—Fasteuing chains.
587. Bridge Standen, Salford—Manure.
588. Philipp and Frederick Schafer, Golden Square—Portmanteaus, bags and cases.
589. J. T. Smith, Lee, Kent—Sight for fire-arms.
590. William Tongue, Bradford—Scutching flax, hemp, &c.
591. A. J. Sedley, Regent Street—Metallic bedsteads and chairs.
592. G. H. and H. R Cottam, St. Pancras Iron Works—Horticultural buildings.
593. Thomas Greenwood, Leeds—Sewing machines.
594. G. F. Guy, Bury St. Edmonds—Motive power engines.

5th March, 1862.

595. John Sidebottom, Harewood, Cheshire—Fire-arms and projectiles.
596. William Tongue, Bradford—Preparing silk, flax, and hemp.
597. J. S. and R. M. Somervell, Netherfield, and Marius Blanc, Birmingham—Boots and shoes.
598. William Heusman, Woburn, and William Hensman. Linslade—Tilling land.
599. John Chubb, St. Paul's Church Yard, and H. M. Burton, Holland Street—Exhibitiug jewellery.
600. Thomas Bostock, Stone, Staffordshire—Boots and shoes.
601. Edward Partington, Heap Bridge, Lancashire—Manufacture of paper.
602. F. N. Gisborne, London Bridge—Railway tickets.
603. W. E. Newton, Chancery Lane—Manufacture of paper.—A communication.
604. Jonathan Barker, Todmorden, Yorkshire—Pulleys, wheels, and hushes.
605. George Lawrence, Westbourne Grove—Flesh gloves and straps.
606. Thomas Hack and A. E. Carter, Kensington—Screw cocks.

7th March, 1862.

607. J. G. Shipley, Regent Street—Bridle heads and bits.
608. M. B. Newton, King's Cross—Drain pipes.
609. Thomas Farrimond, Manchester—Safety cage for mines.
610. Joseph Revell, Dukinfield, Cheshire—Securing rails.
611. John Carpendale and Thomas Middleton, Sheffield—Chasing on silver, &c.
612. John Fowler, David Greig, and Richard Noddings, Leeds—Tilling land.
613. Thomas Ball, William Ball, and John Wilkins, Nottingham—Warp fabrics.
614. Richard Wright, Camborwell—Heating saccharine fluids.
615. Isaac Brook, Basinghall Street—Ladies' dresses
616. Richard Restell, Croydon—Connecting carriages, signal lines.
617. T. H. Wood, Blackweir, Glamorganshire—Artificial fuel.
618. H. B Coathupe, Saint James's—Clips, hooks, and other fastenings.

8th March, 1862.

619. A. W. Williamson, University College—Generating steam.
620. Henry Fletcher, Wood Street—Clip for securing crinolines.
621. George Edmondson, Queenswood, Southamptonshire—Washing machines.
622 Andrew Blair, Dumharton—Rotatory engines.
623. W. Paterson, W. A. and R. Sanderson, Galashiels, Selkirk—Finishing woven fabrics.
624. S. S. Bromhead, Bristol—Receptacles for coals.
625 John Platt and William Richardson, Oldham—Carding cotton.
626. John Deane, King William Street—Revolving fire-arms.
627. W. N. Wilkins, Saint John's Wood—Pigmeuts for Colours.
628. P. J. Guyet, Paris—Water meters.
629. Samuel Grice, Birmingham—Propellers.
630. William Clark, Chancory Lane—Brims and peaks of hats.—A communication.
631. William Palmer, Soutbweald, Essex—Candles
632. John Fleming, Mincing Lane—Pressiug cotton—A communication.
633. F. N. Gishorne, London Bridge, and H. Wickens, Tokenhouse Yard—Fire damp.
634. L. R. Sykes, New Coventry Street—Gloves.
635. F. R. Newton and Hiram Codd, Esher Street—Flow of liquids.
636 J. J. H. Gebhardt, Lawrence Lane—Fastening for albums and hags.—A communication.

10th March, 1862.

637. M. A F. Mennons, Paris—Breech-loading fire-arms.—A communication.
638. James Duncan, Greenock, Renfrewshire—Vinegar.
639. Charles Massi, Greville Street—Retarding and stopping carriages.
640. R. A. Brooman, Fleet Street—Maps, charts, and drawings.—A communication.
641. William Parker and G. H. Batman, Copmanthorpe, Yorkshire—Steam engines.
642. William Spence, Chancery Lane—Projectiles.—A communication.
643. W. J. Bennett, Millbank Street—Artificial stone.
644. A. C. Macleod, Hanover Square—Ventilating hats.
645. W. S. Nosworthy, Coleman Street—Pianofortes.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 7th March, to 8th April, 1862.

Mar.	7,	4451	G. Wing, Sheffield—"Fruit Dessert Dishes and Plates."
,,	11,	4452	B. Nicoll, Piccadilly—"Shirt Collar."
,,	12,	4453	C. Topham, Cannon-street, E.C—"Brush for Polishing Boots and Shoes."
,,	15,	4454	A. W. Banks, Newgate-street, E.C—"Sponge Bag."
,,	19,	4455	Mappin & Co., Oxford-street, W.—"Travelling and Dressing Bag."
,,	20,	4456	Nicholson & Evans, Sheffield—"Parallel Vice."
,,	26,	4457	Cottom & Co., Oxford-street, W.—"Loose Boxes of Stables."
,,	29,	4458	F. Mège, Cavendish-square, W.—"Parts of Jewellery."
,,	31.	4459	T. Bianchi, London, E C.—"Box Chest and Case Fittings."
April	1,	4460	H. Hyman, Birmingham—"Ring."
,,	,,	4461	W. Partridge, Woolwich—"Spring Bale Hook."
,,	7,	4462	Silber and Fleming, Wood Street—"A fastening for Purses, &c."
,,	8,	4463	John Bayley, Chelsea—"Accoustic Cornet."
,,	,,	4464	John Bayley, Chelsea—"Accoustics for Musical Instruments."

NOTICES OF THE PROGRESS OF THE INTERNATIONAL EXHIBITION.

THE OPENING.

The great artistic and industrial display of 1862 has now been opened, with such pomp, as the absence of the Queen and the sombre shadow due to the universal remembrance of the cause of that absence, admitted, and with such ceremonies as the taste of the Royal Commissioners was good enough to suggest.

As, during the remainder of this year, this *Journal* will necessarily become in part occupied, month by month, with the overflowings of matter, for which we may not be able to find place or space in our supplemental work, "The Exhibition Record," and also with many notices and contributions presented to us by Exhibitors, British or Foreign, or by others interested in the Exhibition, and selections of which, we shall be prepared to publish and to illustrate, so we purpose to devote a space monthly to what may be denominated "Notices of the Progress of the Exhibition."

In these our matter must take the limit that is proper to our speciality. It is, therefore, not for us to tell again, what has been already so much more graphically described in many of the leading papers, how that, marvellous progress in arrangement had, within the last few days of April, been achieved. That the building was tolerably clean and quiet upon the opening morning, which, ushered in by showers enough to lay the dust, was for the rest, as to weather, one of those "Queen's Days" to bring vividly to memory the bright pageantry of eleven years ago. How, as to real fitness for being opened "to time," the opening was very much of a solemn sham, though blessed and prayed upon by Episcopacy in person. How that, after some thousands of season ticket-holders had humbly waited at the closed doors until the hour at which it pleased the Commissioners to let the doors be opened, they found, on gaining the interior, that the time had been employed by these functionaries or their employées in providing reserved seats for those who had the "private entré," and that, if there were any reserved seats, as promised beforehand, there were no persons to point them out, or who knew where they were. How good-humouredly numbers entitled to these reservations (ourselves included) put up with the nave rather than attempt again a forlorn hope of the escalade of stair-cases that always appeared to lead to the wrong place. Finally, that, with most dissonant clang of trumpets in the interior of the building, (how different to English ears to the jolly sounds echoed from outside in '51, "P'sent arms," accompanied by the clash of steel, and the heavy diapason beat of the distant "God Save the Queen," and more distant chorus of cheering), a disjointed, meagre, heterogeneous, (and were it not for the real greatness of some who took part in it, we might almost say contemptible) procession, marched up one lane-way of some twelve feet wide, between deal barriers of the Smithfield pattern, and discovered a use for the western dome—and, after a little, trotted back again by the other long pen, to demonstrate under the eastern dome, that there were two domes to the house, and that a use must be found for both of them; and that the thought that brimmed up in every reflective mind of the thousands at either side, of these miserably ill-devised passages and proceedings was, that it was an act of great self-abnegation for public duty sake, on the part of Lord Palmerston, and such other real "kings of men" as were there, to permit themselves to be made parts of a display so tasteless and vulgarized—in some respects so utterly grotesque and absurd. "Tell it not in Gath" that a procession, in which the Blood Royal of England and Prussia moved, that ought to have had, dignity, as it was dignified by, the presence of heads grown gray and venerable in the services of, the statesman, of science, and of letters, was wound up and climaxed by—four Scotch bagpipers.

Other ceremony, visible to even a "good few," as our Scottish friends say, there was none. The unhappy ground plan or form of the building forbade it. The great centre point—the one intersection of nave and transepts—the wisdom of our ancestors in the old cathedral form, by such a happy intuition copied in 1851—was wanting; and, between the towering mob, of uncouth and inharmonious things, called trophies (save the mark) in the nave, and the cutting off from all visible existence of the transepts, by the so-called *daises* under the domes; nothing of what took place at either, could be seen except by those close around on floor or in galleries, except, indeed, the orchestra and vocalists under the eastern dome—a sloping and embosomed hill of closely-packed, bright, women's faces and gaily-coloured toilettes, that made the great concave sparkling as a flower-bed. This was literally the only redeeming point of beauty, in the whole concern.

At the gallery level of this eastern dome, a great *velabrum*—a sort of flat bell-tent of oiled canvas—was stretched over its whole area, with the intention of concentrating the wave of sound from the musicians beneath, and delivering it in full volume outwards along the nave; but although it, no doubt, had *some* such effect, the fact was, that nothing but the *fortissimo* passages of even this prodigious crowd of musicians could be heard at the mid-length of the nave, and at the western dome, of course, not at all.

Acoustically nothing could have been worse than placing the orchestra at the intersection of the two strokes of a T, the top stroke being two of the so called transepts, i.e., the *trans-septa* that neither cross the nave, nor separate it from anything. Nothing short of Mons. König's beautiful instruments, amongst the French physical apparatus, for writing down upon paper, *visual music* so to say—the marvellous curves of sound waves, or even the sound vibrations of the drum of the human ear, could give even an idea, of the inconceivable complication of sound undulations, that must regurgitate to and fro the ends, of both limbs of these transepts, over and about the place where the orchestra stood, and thence, flutter feebly and broken winged down the nave. Those who remember 1851, will recollect that the organ that was placed at the western end of the nave, was easily and distinctly heard, on the most crowded days, up at the intersection of the transepts, and at quiet times could be heard even still further to the eastward. Acoustically the building is quite ill-suited to great musical performances, at any point concentrated whatsoever; but had as it must always be in this respect, it was made the worst of, upon this occasion, by the unhappy choice of position for the orchestra.

This should have been (so far as sound is concerned) built up, right across the centre nave, about one fourth of its length to the east from the western dome, and with its slope facing westward, and run up as high as possible, with a closed-in-back — and all the ceremonial, should have gone on, under the one western dome, and in the two limbs of the western transepts. The sounds would have thoroughly well filled this space, when thus emanating; and by proper arrangements, every one present might have been enabled both to see and hear all that went on, more or less satisfactorily. But then, the architectural absurdity of the *two* domes would have become glaring, and in the hope to save this as we imagine, the absurdity of trotting in procession, from one dome to the other was devised. The *throne*, being one holy station of pilgrimage, the *fiddlers* the other; and, the result being, that few saw anything, fewer still heard anything, of what was, no doubt, noble music, and in part, "wedded to immortal verse," and all with even a share of good taste, were disgusted.

It is very pleasant to be able to say something and truly, in commendation. Well, one portion, of the most worthy part of the whole, the Fine Art display, does deserve most unqualified praise, and demands that due attention be called to it. We are greatly disposed to say, that the east and west corner towers, do really solve the problem of picture gallery illumination. The light in these is absolutely perfect; abundant, full and mellow, and thoroughly diffused, and *every* individual picture, upon the walls of these two tribune rooms, can be seen with the most perfect satisfaction *from every point* of the floor.

Good, as undoubtedly is the light of all the front picture gallery, it is only of these two great corner tower rooms that the above can be said.

Now, what does this arise from? Those who go into the rooms, or who have even examined our sections, in Part I. of the *Exhibition Record*, (supplement for May) will see that the whole of the light is admitted at *an enormous height from the floor*, and that the admitting aperture is large enough to let in plenty of it.

It pours in *vertically* overhead, but it enters at so great a height, that before it has descended even to the level of the highest point of the wall at which paintings are hung—even and perfect diffusion has taken place; and with bright clear light, there is not a particle of glitter from the face of any picture, nor any necessity for dull screens of calico overhead—not even in bright sun light.

A great experiment, (however, it may be by chance) has here been made, and is well-worthy the attention of our artists and architects, concerned in picture gallery construction. The deduction we make is, that all picture galleries ought to be increased greatly in total height, to what is their usual proportioning, and, above even that, of the *long* gallery of the Exhibition building, and the light poured in at a great height above the heads of the spectators, and far above the highest "hanging line."

In our *Record* account of the construction of the building of this year, we said but little as to the structure of the staircases. One or two points about these, suggest a few remarks.

The arrangement, of the cast-iron framing carrying the steps of those staircases, has evidently been made by the architect with a view to addition of structural stability, to the gallery floors and domes. And this object has been to a great degree attained, and with a good deal of constructive ingenuity. The staircases at the corners of the galleries at the domes, would have, perhaps, given greater strutting to the latter, had they been sloped the reverse way, and yet been equally good as gallery approaches. The staircases at either side of the central nave to the galleries are placed across the axis of the nave, and two separate flights, each continuous except for a narrow mid landing, are parallel to each other, and slope up in opposite directions, so as on the side to be like the letter X. Great rigidity horizontally is given by this to the floors above, much more indeed, than their weak and ill-laid planking is competent to transmit to any great distance, in the plane of the flooring. but the continuity of such flights, partically unbroken, and rising to the height of 25 feet vertically, with the usual proportion of "tread and riser," results in this awkward effect; that, what with the height and slope above the eye, and the amplitude and curtness of crinoline, a person standing at the foot or just beginning to mount, one of these staircases, has the opportunity of judging of the proportions of the limbs of his lady friends, who may be on the point of coming down, to an extent that only a favoured few by nature, if any at all, will like. For this there is no remedy now, unless it be for the commissioners to import the discipline of a Quakers' meeting house, upon the stairs, and ordain separate flights for men and women; and that those of the latter are not to be profaned by male eyes; and we don't suppose this will be tried.

In our first part of the Exhibition Record we showed, in pretty reliable figures, that under no possible conditions could this building of 1862 be held to be a cheap one, nor be compared, in value for the cost, with the Crystal Palace of 1851.

Sir Charles Fox, whose personal merits in connection with that structure we have endeavoured to place in a just light in the above part, has, however, gone further. In two letters addressed to the *Times* he corrects the error into which that paper had fallen, as to the relative costs of those buildings; and in the second letter, which we subjoin, he shows that this building of 1862 has cost not only a great deal more than the glass structure of 1851, but has cost (upon the data *already* published) more than even the Crystal Palace at Sydenham.

We had no immediate access to financial information as to Sydenham, when writing, but are not ill pleased to find that the constructional judgment that we pronounced in the Record, as to the necessarily expensive character of buildings, such as this of 1862, as compared with those of glass and iron only, with brick building envelope, is thus substantiated and confirmed—

THE CRYSTAL PALACE AT SYDENHAM AND THE INTERNATIONAL EXHIBITION.

To the Editor of the Times.

Sir,—Since writing my letter of the 2d inst., which you have done me the favour to publish in your edition of this day, I have carefully taken out the actual costs of the Exhibition building of 1851 and of the present Crystal Palace building at Sydenham (both of which were constructed by my late firm, Messrs Fox, Henderson, and Co.), and find them as follows:—

	£	s.	d.
Total sum paid by the Royal Commissioners for the Exhibition building in 1851, ...	161,000	0	0
Amount paid by the Crystal Palace Company for the Crystal Palace building at Sydenham (including the purchase of the Exhibition building) ...	235,540	0	0
Total cost of the two buildings, ...	£396,540	0	0

Showing that the cost of these two buildings together falls short of the contract price of the present building for the International Exhibition of 1862—viz., £430,000—by the sum of £33,460.

From the above it is evident how large an error was involved in the statement referred to in my former letter, to the effect that "Some injustice is unconsciously done to the present building by comparing it with the Crystal Palace at Sydenham, which cost five times the money, instead of with the Crystal Palace of 1851."

I am, Sir, your obedient servant,

Charles Fox.

Spring-gardens, London, May 3.

These notices of progress are not intended to be systematic. We conclude the present one with the following table, from which a tolerably correct notion can be formed at a glance, both of the relative *energies* of exposition, of the different foreign countries, and of the *characters* of their respective *products*.

The general catalogues for British and foreign expositors are published, but their consultant value is greatly diminished, by the want of an index at the end, referring, by number or page, to every place within the building, where an example of *each speciality* is to be found. For example, an index that should enable a person anxious to see *all that was to be seen* everywhere in the building, relating to copper ores, to find the scattered specimens at once. At present he can only do so by nearly reading over the catalogue. The Illustrated catalogue is also (part 1) published, and from the way it is being treated by the Commissioners, bids fair to be utterly useless as a work of information, to the expert, the manufacturer, or the man of science; and, in fact, to be nothing but a gigantic puffing advertisement book, and having no aim or end but to "put money in their purse." Is this worthy, is it faithful, in a professing Science and Art Department? Ed.

ANALYTICAL TABLE OF FOREIGN EXHIBITORS, SHOWING THEIR DIVISIONS IN THE 36 CLASSES.

List of Foreign Countries Exhibiting.	Class 1. Mining and Mineral Products.	Class 2. Chemical Substances and Products.	Class 3. Substances used for Food.	Class 4. Substances used in Manufactures.	Class 5. Railway Plant and Engines.	Class 6. Carriages not connected with Rail or Tramroads.	Class 7. Manufacturing Machines and Tools.	Class 8. Machinery in General.	Class 9. Agricultural and Horticultural Implements.	Class 10. Civil Engineering.	Class 11. Military Engineering, Ordnance, and Arms.	Class 12. Naval Architecture.	Class 13. Philosophical Instruments.	Class 14. Photographic Apparatus and Photography.	Class 15. Horological Instruments.	Class 16. Musical Instruments.	Class 17. Surgical Instruments.	Class 18. Cotton.	Class 19. Flax and Hemp.	Class 20. Silk and Velvet.	Class 21. Woollen and Worsted Fabrics.	Class 22. Carpets.	Class 23. Specimens of Printing or Dyeing	Class 24. Tapestry, Lace, and Embroidery.	Class 25 Skins, Fur, Feathers, and Hair.	Class 26. Leather, Saddlery, and Harness.	Class 27. Articles of Clothing.	Class 28. Stationery, Printing, and Bookbinding.	Class 29. Educational Works and Appliances.	Class 30. Furniture, Paperhanging, and Decoration	Class 31. Iron and General Hardware.	Class 32. Steel Cutlery and Edge Tools.	Class 33. Jewellery and Precious Metals.	Class 34. Glass, Decorative and Household.	Class 35. Pottery.	Class 36. Toilet and Miscellaneous Articles.	Total Exhibitors.
Africa, Central, ...	—	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	4
Africa, Western, ...	1	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	8
Belgium, ...	36	21	79	59	14	4	46	22	19	22	22	1	8	9	1	11	4	42	86	4	85	5	4	46	13	27	22	34	6	27	49	7	5	17	5	1	863
Brazil, ...	16	6	73	31	—	—	1	—	1	—	3	4	2	2	1	—	1	13	3	1	2	—	—	—	2	0	15	6	—	14	11	2	3	3	4	1	230
China, ...	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	2	14	25
Costa Rica, ...	Com.	Com.	Com.	Com.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Com.	—	—	Com.	Com.	Com	—	—	—	—	—	Com.	—	—	Com.	—
Denmark, ...	3	14	41	37	—	2	6	1	5	2	2	9	4	7	5	12	3	1	2	—	10	5	1	7	6	13	18	13	12	27	12	—	14	1	4	—	299
France & Colonies, .	98	153	$1466	108	30	13	48	90	42	45	39	17	57	119	54	67	58	50	25	150	170	11	54	60	14	61	165	134	38	229	—	44	71	34	37	63	3,023
Germany—Austria, .	80	00	232	139	7	2	13	25	21	21	14	3	21	12	10	42	8	24	22	38	135	4	21	20	17	23	72	30	63	23	08	99	22	23	10	16	1,509
* " Zollvercin States	208	155	224	146	12	5	30	63	12	50	33	1	55	26	44	71	16	53	73	43	228	10	10	29	26	82	118	149	62	89	147	26	52	24	40	41	2,531
† " Hanse Towns, .	2	4	18	5	—	1	7	2	—	1	1	3	2	—	3	13	3	—	1	—	—	1	1	4	—	6	17	10	2	43	11	1	3	3	2	12	182
Greece, ...	15	6	114	63	—	—	1	2	—	13	2	—	—	2	—	—	—	6	—	5	1	11	—	3	1	10	18	2	—	4	1	—	1	—	—	2	283
Hayti, ...	Com.	—	Com.	Com.	—	—	—	—	—	—	—	—	—	—	—	—	—	Com.	—	—	—	—	—	—	—	Com.	—	—	—	Com.	—	—	—	—	—	Com.	—
‡ Ionian Islands, ...	7	27	41	3	—	—	—	—	—	—	—	—	—	—	1	—	—	6	4	12	—	4	—	6	—	2	18	—	—	8	—	—	7	—	1	29	176
Italy, ...	118	75	280	178	7	1	12	10	45	16	28	—	5	6	4	10	16	16	21	125	15	4	5	13	5	20	36	23	32	64	35	17	18	9	13	1	1,289
Japan, ...	1	1	1	—	—	—	—	—	—	—	2	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	2	2	17
Madagascar, ...	2	—	—	1	—	—	3	—	—	—	3	—	—	—	—	1	—	—	—	1	1	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	13
Netherlands and Colony of Java, ...	2	27	60	30	—	6	2	5	11	13	2	5	15	2	—	10	4	4	18	2	11	3	3	6	9	4	11	21	4	20	22	—	7	4	10	1	354
Norway, ...	22	10	22	6	—	4	4	4	7	2	5	11	3	1	3	3	3	8	6	—	3	4	—	2	2	13	13	11	6	2	11	1	3	—	1	35	231
Peru, ...	1	1	3	2	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	1	—	—	—	—	—	—	—	—	—	—	—	2	—	—	1	14
Portugal & Colonies.	77	45	639	144	—	—	4	2	11	2	—	—	1	1	—	2	1	19	11	14	17	—	6	11	7	9	15	11	1	2	3	1	—	1	12	63	1,132
Rome, ...	6	4	—	6	—	—	1	2	2	1	2	—	1	5	—	—	—	—	—	2	—	—	—	2	—	—	—	3	—	4	—	1	1	—	1	9	53
Russia, ...	32	23	133	94	2	12	2	2	6	10	15	5	5	9	1	2	2	15	13	28	20	6	11	14	22	26	53	9	10	8	10	15	11	4	4	6	658
Siam, ...	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	3	10
Spain, ...	156	20	505	93	3	—	1	6	2	2	8	1	—	—	1	2	7	12	41	32	40	—	—	8	1	13	28	14	—	12	7	4	2	16	—	6	1,133
Sweden, ...	84	32	72	37	5	4	6	0	22	18	10	3	12	3	5	3	2	17	11	3	21	—	2	5	10	6	17	16	12	16	25	9	8	3	3	—	511
Switzerland, ...	6	9	58	10	—	—	7	9	3	6	9	2	10	4	72	0	2	20	1	57	6	1	6	12	3	7	14	4	6	6	8	2	14	—	3	2	387
United States, ...	3	4	6	1	3	2	6	22	12	2	1	—	—	—	—	4	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	68
Uraguay, ...	3	—	14	12	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	6	—	—	—	—	—	—	—	—	2	2	41
Totals, ...	1,048	732	4,182	1,207	83	56	200	276	221	226	202	65	201	208	206	262	133	312	338	520	784	78	133	248	139	337	648	491	254	612	459	229	224	142	156	313	15,944

* Zoll Verein States.—Anhalt-Bernburg, Anhalt-Dessau Cothen, Grossherzogthum Baden, Bavaria, Brunswick, Frankfort-on-Main, Hanover, Hesse Cassel, Grand Duchy of Hesse, Lippe, Luxemburg, Nassau, Oldenburg, Prussia Saxony and Reuss, Grand Duchy of Saxony, Saxe Altenburg, Saxe Coburg Gotha, Saxe Meiningen, Schwarzburg, Rudolstadt, Schwarzburg-Sondershausen, Waldeck, Wurtemburg, Mecklenburg-Schwerin.

† Hanse Towns.—Bremen, Hamburg, Lubeck. ‡ Ionian Islands.—Cephalonia, Cerigo, Corfu, Ithaca, Paxo, Santa Maura, Zante. § Classification in catalogue very imperfect.

MARINE ENGINES.

There are some superb examples of marine engine work in the International Exhibition. Maudslay, Sou & Field preseut a noble pair of 82 iuch horizontal cylinders, 4 ft. stroke, with quadruple steam-passages in double slides, and cylinders jacketted at sides and tops, every part bearing the impress of those proportions aud that style and perfection of workmanship that descended to these celebrated makers from Henry Maudslay's days from him who founded the house. Close by tbese are John Penn & Son's 600 horse-power Trunk Engines for Spain, and the 112 inch cylinder of tbe future engines of the Achilles, with one of their crank shafts and connecting rod. And next are Humphrys and Tennant's 400 horse power (collective) horizontal engines for the *North Star*, twin engines to those built by them for the *Albion*, and on board that ship worked up to 4·60 times nearly their nominal power, by indicator. Not far off is a pair of inverted cylinder engines by Tod and M'Gregor. At the upper end of the annexe, amongst the foreigners, is a pair of French engines from makers at Marseilles, also with horizontal cylinders, and characterized by the good workmanship and slender proportions of many parts—so usual in foreign work—and with a most unlikely looking screw propeller in bronze beside them.

Besides these, we have a much smaller pair of foreign boat engines, driving paddle wheels, with inclined cylinders, and erected iu a section of the iron boat they arc, as we presume, intended for. Tbese are, we will not say all, but thcy are the most remarkable examples, that in a first cursory examination of the machinery department, met our eyes. In all of them we might spend some time in pointing out cxeellencies of material, adaptation, work; but, throughout the whole display, we look in vain for anything showing any great advance, not already fully published, or for any indication of attempt at radical improvement.

Nothing otherwise was, howcver, to have been expected. The "car of scieuce" lumbers along very slowly when it has to be responsible for the safe conduct and issue of things as ponderous and costly as marine engines. Improvers are very conservative when experimenting with apparatus that costs £50,000. This has been and is, one iuain cause of the fact, that steam engine improvement, and especially marine engine improvement, has been more tardy than almost any other great branch of mechanical engineering. These great Exhibitions are besides, stock-takings of the things done, not of those still endeavouring to be done. Every exhibitor who has a reputation to lose resolves to show only what he has already achieved with an assured good success. The novelties, as a rule, will be found to belong to those whose reputation is yet to win, and this class scarcely appears this year amongst the marine engineers.

And, yet, in marine engine making, we hesitate not to say, there is still open the grandest field for invention and discovery, and offering the most stupendous results to the successful, of any branch of mcchanics—structural or dynamic—embraced in the wide word, engineering.

The old side lever engines gave way slowly to those of direct action —Gorgon's, or Steeple's, or Forrester's inverted, or oscillating; by the demand for more power, and the necessity of economizing ship space and weight of material to float it.

The screw propeller, no more than an ingenious dream of possibility in Tredgold's early day, indeed for long after, was at last tried, was found to possess unexpected powers of propulson, combined with other great advantages, and henceforth its progress was sure, and has been steady, if not rapid, so that now the thought of the future is; may not the screw ultimately be made to transfer the power of the engines as fully and economically as the paddle?

These were all *ante* Exhibition advances however; all were *en route* in 1851. Even then, too, we had tubular boilers, since so extensively employed, and all these changes, great and higbly important as they are in result, are, with the exception of the screw propeller, improvements in structural detail, compelled by anterior necessities to be met. What then have we to show for the decade that has passed? It has not been barren. We have high pressure steam aud expansive action, that was an experiment in 1832, widely realized from 1851 to 1862. We have surface condensation, that was in 1836 but an abortive trial, also, witbin the last ten years, become established in use mainly because, by some very simple though most ingenious means, the difficulties in making a vapour tight condenser, which were irresoluble iu Samuel Hall's time, have since been overcome.

Something, too, within ten years, has been done in producing better combustion iu the furnaces of boilers—in proportioning and diffusing the supply of air, and so, in reducing the production of smoke, or "burning the smoke," as it is still commonly called. Last of all has come to be a firmly-established and most prodigious advance, the use of superheated steam. The value of this in principle was far from new or unstated in 1851. Haycraft & Howard in Englaud, bad, as early as 1829 or 1830, pointed out the great outlines of its theory, and the important results to be expected from its employment. The former had previously been still more fully treated of by foreign engineers or physicists; but it was not until about 1853-54 that the importance of the economy to be effected by superheating the steam became impressed upon engineers and steam ship owners, by trials upon a large scale, and with accurately measured results. In 1854-55, Mr John Wethered, of the United States, introduced his system of combined steam, as he called it, into this country, and its success on board tbe Admiralty ship the *Black Eagle* gave the fiual great impulse to superheating.

There is probably not much in this peculiar *method* of superheating, called *combined steam*, of advautage over any other method of superheating, except that it gives the means of not super-superheating—of not heating the steam so much, and so unnecessarily, as to char the packings and lubricants, and so wearing out all rubbing surfaces, and greatly increasing friction. All these evils seem to have been found as results by the early experimenters; in fact, it was not until latcr years that the theory of the process was understood with sufficient lucidity and exactness to enable the point to which superheating should be carried, and beyond which it is useless, to be well known. In a few words, superheating, however done, is no more than this. Steam as evolved saturated, and at the ordinary boiling point from water, does not follow the law of expansion by beat of permanent gases, as established for the latter by Dalton and Gay Lussac. It is, in fact, still on the verge of being water, and witb the first increments of beat, above the point of saturation, its expansion is very rapid—four or five times as great as that of air, for equal increase of heat—afterwards, and for higher temperatures, its expansion almost exactly follows the law of permanently elastic fluids, so that the curve of its expansion is, in fact, an hyperbola, whose asymptote is parallel to a right line that represents the expausion of air.

Rudberg, Magnus, & Regnault had, by their results as to the expansions of various gases, indicated the likelihood that such would prove to be the fact for steam.

The earliest proposers of superheated steam seem to have thought mainly of the advantage to be gained, by merely increasing the volume of vapour at a given tension, or tension for a given volume, that if saturated steam were heatcd 496° Fahr., its volume would be doubled, and, as they supposed, double the work got out of it—and hence they *over*-heated their steam, and caused it to burn the oil and packing. As the capacity for heat of saturated steam is large, this expansion, iu reality, offers little or no advantage; but indirectly, or in virtue of a secondary set of conditions, superheating the steam has been found, in practice, to realize all the great advantages that sound theory indicates.

If we are to use saturated steam to its best advantage, we must let it expaud from high to low pressure in the cylinder, or in two combined cylinders; but steam, in expanding behind a piston, loses a certain portion of its heat, which is converted into mechanical effect or work. This is absolutely lost and gone; and if the steam be at, or very near its point of saturation, some of it must condense into water. The water produced, became revaporized when the tension within the cylinder was further reduced hy expansion, and in so doing robbed the sides of the cylinder of heat, which had to be again made up, by that of the steam introduced at the next stroke.

The result was, that a certain volume of steam passed at every stroke through the cylinder that gave no return in work upon the piston. The remedy for this is, just sufficiently to increase the temperature of the steam entering the cylinder, that it may be able to expand to the end of the stroke without any condensation. Practically, it may be advantageous to carry the superheated temperature somewhat beyond this, but much beyond this point will not be attended with any considerable economy, and must be accompanied by practical evils, in the wear and working of the engine, even with metallic packed pistons, and possibly metallic packed glands.

Jacketting. the advantages of which were so clearly seen by Watt, provides no remedy for *this* defect in the use of saturated expansive steam—superheat is that which comes to our aid.

And now, what has it done? Take the examples of some of the Peninsular and Oriental Company's vessels, built by Humphrys and Tennant, and altered hy them between 1857 and 1859.

The *Ceylon*, with 72 inch cylinders, 3 feet stroke, 50 to 60 strokes per minute, from the results of 42,000 miles running, in seven passages, with saturated (ordinary) steam, burnt 1500 tons per voyage. Superheating, to the extent of 100° (which is just about what theory indicates to be sufficient to prevent condensation in ordinary expansive engines) was applied, and the result was, on 30,000 miles running, or five voyages, a consumption reduced to 1100 tons per voyage. Here is a saving of nearly *one-fourth the fuel* at a single blow; but probably the *Ceylon's* engines were doing (as things go with marine engines) about the very best possible duty, with their ordinary steam before. In engines uot so favourable, tbe results of the improvement were still more striking. In the *Alhambra*, the consumption of fuel before was 19 cwt. per hour; after superheating, it was only 13 cwt., or nearly *one-third* saved. In the *Nepaul*, it was more remarkable yet; her consumption, with ordinary steam, was 36 tons per day; when superheated, it was reduced to 17 tons iu the same time, or the ecouomisation approached to *one-half*.

These are great achievements, due to a single application, pointed to

by theory, and appertaining merely, to the application of the steam in the cylinder.

Yet, how much more remains to be accomplished, to which already we see our way more or less clearly! Much as every mechanic's eye must admire these noble samples of experience and workmanship, the huge marine engines at the Exhibition present, we feel satisfied that before another half century shall have passed, men will look back with wonder and curiosity at the fact, that an enormously large portion of the total cargo of every steam ship of 1862, consisted of her engines, boiler, and coal; and that the weight and bulk of these enormous and expensive factors, were what set the limits practically to the speed, to the cost, and to the length of those sea passages, by which man is destined in the end, freely to "run to and fro in the earth."

Messrs Mandlays' engines alone, must weigh close upon 200 tons. Is all this prodigious mass of metal indispensable, to suck out the work from the coal, their boilers will necessarily burn, and transmit it through screw or paddle, to water and ship?

Wherever the first *point d'appui*, is a cylinder of 90 or 112 inches diameter, doubtless all the rest follow—piston rod, crank, and frame, all must be in proportion; but is there no clue out of this labyrinth of tremendous piston and connecting rods, pipes, and valves to match?

One of the minor advances made on marine engines, has consisted in increasing the travelling speed of the piston. In old side lever days, this was just the conservative pace of Watt's day—220 feet per minute. Now it has got up to 500, or even 700 feet per minute, and with all the real evils of excessively short stroke. Does not even this suggest the question, whether smaller cylinders, much higher pressures of boiler, larger expansion, with superheating, and much more rapid reciprocation, might not bring the marine engine to a more manageable weight and bulk than yet obtained, and, in both respects, to more nearly a par with the relation between power and weight, that subsists in the locomotive? At 40 miles an hour, many of the large locomotives now return an actual power, between one-third and one-half, that of the largest class of marine engines—the relative weights being, say as 40 tons to 400.

If we can increase the *speed* at the working point, we assuredly can diminish the mass and bulk of the fixed and moving parts of the machine first recipient of the power of the fuel.

In another direction, we may see this realised. At the Katrine cotton mills, we see Fairbairn's four prodigious overshot water wheels, slowly revolving and carrying round upon their own ponderous rings, tons and tons of water, to return back in work, some fraction of sun heat in vapour and rain. If we go into the Black Forest of Germany, we may see a whirling turbine, not much bigger than a tambourine, revolving so fast that the eye can see nothing of it, and with the water rushing through, with such a gush, that the sheet iron ajutages are actually abraded away by the liquid, in a few weeks; and yet this apparent whirligig toy is realising as much power nearly, as one of the Katrine wheels, and working a whole manufactory. Is there no way possible to increase the speed at the working point on board ship?

This brings on the question of boilers. Confessedly, our existing models of boilers, safe to 30 lbs., perhaps capable, by thought and modification, to be made safe up to 60 lbs. plus pressure, are quite unsuited to really high pressure steam—to such pressures as are now in daily use in locomotive work, 150 or 250 lbs. to the square inch. But if surface condensation be a reality—if distilled water can be the food for evaporation—are we always destined to lug about a boiler that shall weigh 100 tons, or more or less, and in it, its own weight of water, surging and plunging about inside, in order that in this we may have the apparatus to rob the coal of its heat, by evaporating other water constantly added, and abstracted as steam, from this huge inert mass of liquid!

Are Bontigny's beautiful results, in which he showed, that if we compel the contact, of water and a metallic surface heated to a determinate degree, (which is its maximum steam producing temperature), we can flash it off into steam, with the rapidity almost, of the gases evolved from the explosion of gunpowder, to remain valueless to us?

In another part of our Journal for this month will be found a letter on Steam Generators, by Mr Charles F. Hayes, of Enfield Small Arms Factory, descriptive of a steam generator of his at work there, of which he invites inspection. We have not seen it ourselves, and merely refer to it here as one example of the class of boiler of the future according to our own promptings.

Years since it has been known, that small boilers, large fire surface, and combustion at high temperatures, can be made to give results as good at least, as the slow combustion, and immense surface, of the Cornish system. In our own view, properly applied, the system of intense combustion *must* beat any slow combustion system in economy; but even with far inferior results as to fuel to the Cornish boiler, or even to the locomotive, any light and compact marine steam generator, that could replace the present ponderous marine boiler, would be an immense advance in steam navigation.

The mere suggestion, is no doubt met by many orthodox marine engineers with raised eyebrows and compassionate looks, perhaps by a few such *disjecta*, as "complication," "want of strength," "small tube," "danger." Nevertheless, we believe it is the destined "*avenir*" of the marine boiler, and with it—or much more probably, without it, that is to say before it,—we believe will come two other things,—the one a vast improvement whenever it shall be tried "on things as they are;" the other, one that when once established, will revolutionise the boiler and fuel departments of our ships.

The first is the application of Siemens' regenerative system of furnaces to marine boilers, whereby, as we imagine, a very notable saving indeed, may be made in the consumption of the very best of such, working as now usual.

There are few large steamers now afloat in which the *flame* from the furnaces, does not reach the base of the funnel, and it may often be seen at night actually lipping over its summit, while probably, in the very best of cases, the gases of combustion, along with a large weight of unburnt carbon, escape at the top of the funnel, at from 400° to 600° Fahr. All this enormous waste of heat may be locked up and laid by in store, and presently returned, through the fuel in the act of being burned, thus evolving it into steam, and work at last, in place of wasting it wholly.

But further, in saving it, we get the means of feeding the fires with hot air in place of cold, increasing the intensity and the perfectness of the combustion, preventing smoke, (in itself a valuable end as a war ship requisite), and making use of the flocculent carbon that now flies away into the atmosphere.

This no doubt will be done. We believe Mr Siemens, the inventor and patentee, sees no difficulty in it. As we have recently given an account of his furnaces, we shall say no more on this point here.

But as to the second advance, of the future boiler, at which we have hinted, it lies in the abandonment of solid fuel—of coal—altogether, and in the employment solely of liquid fuel, of liquid coal, as we may say, for marine purposes. We cannot here find space to go as fully into this matter as we could wish, we can but jot some hints, that may be enough to set those already acquainted with such subjects thinking.

Amongst the remarkable discoveries that have unexpectedly been made within a few years, of previously unknown, or only analogously known products, none is more strange than that of the mineral oils of North America.

Hydocarbons, of various sorts, were long known, as rather rare mineral products, of Persia, Rangoon, Mexico, Trinidad, &c., but a *liquid coal formation*, in the exhaustless abundance, of a solid coal seam, remained unknown until within a year or so past. It is even now but just commencing to come amongst us in large quantity; and for the purposes for which it is, as yet, imported, viz., for burning in domestic lamps, we hope it may have as little demand as its dangerous character (with existing lamps at least) deserves; but liquid hydrocarbons, we believe, are destined to be the marine fuel of the future. Weight for weight, these natural liquid coals may have more or less absolute, *i.e.*, theoretic, calorific power than the best coal; but, practically, as boiler fuel, and especially as generator fuel, with Siemens' furnaces, we feel certain they will be enormously more valuable than coal. First they produce nothing but *flame*, that is to say, their entire combustion (given enough air) is at intense temperature. We can, therefore, prolong the application of a high temperature, to every part of the boiler flues, as well as to the furnace itself. There may be absolutely *no smoke*. There can be no ashes, or coal broken into useless dust. What is the precise per centage of these together, now thrown overboard under the name of ashes, we do not know, but it is very great. The whole space of stowage devoted to fuel on board would be in the very bottom of the ship, in space now useless, and be solidly filled with liquid coal, and not partially, as in coal bunkers, neither interstices nor space for fear of heating being required. The supply of fuel can be precisely proportioned to the demand at every moment; furnaces fed with liquid fuel may, like gas, be "turned down to blue," and the water kept boiling for days together, in the ship's boiler or generator, or at once it may be urged to its highest steam evolving power. Every one knows that pitch pine and lard, are the racing fuel of days gone by, in American steamboats, and that turpentined wood is the fuel of American steam fire-engines, that get up steam in six or seven minutes. The power of these fuels, as also of the Swansea patent fuel, with a proportion of which our ocean steamers are supplied, is due to the facility with which their volatile hydrocarbons are evolved and sent into prolonged flame.

On the other hand, the theoretic man knows, that a pound of anthracite or of blacklead ought to give him more heat (if he could practically get it out, in any available form) than a pound of pine-wood, or even of good coal. The *real* value of a fuel, as Dr Percy has so well pointed out in his "Metallurgy," is, in fact, a matter of compromise, and in this compromise we believe that these new combustible treasures that nature has now offered to us, in the Canadian and American oil springs, will be found to offer advantages at sea greatly beyond anything that can be realized with coal. Their supply will no doubt be boundless, for already Cuba has come into market to offer analogous substances, and the under stratum of Trinidad is probably a reservoir of like material.

The innovation, of their employment as marine fuel will be great; and before even a trial will be ventured, grave heads will be shaken at the danger to be apprehended, from large boiler plate tanks of such combustible materials on board. To such objection, *in limine*, we only say—

Look at the gas lights around you; remember that seareely fifty years ago, Sir Humphrey Davy, the foremost man of his day, in England at least, as a ehemist and physieist, seoffed at the idea of publie gas lights as an impraetieable utopia, and that the alleged *danger* of gas when stored in large masses, was shared in by almost all tbe men of science and of practice of his day. Doubtless, when gunpowder was first put on board ships, heads were shaken too, and the eertainty of destruetion, from a magazine in a ship, duly foreseen; yet very few magazines blow up.

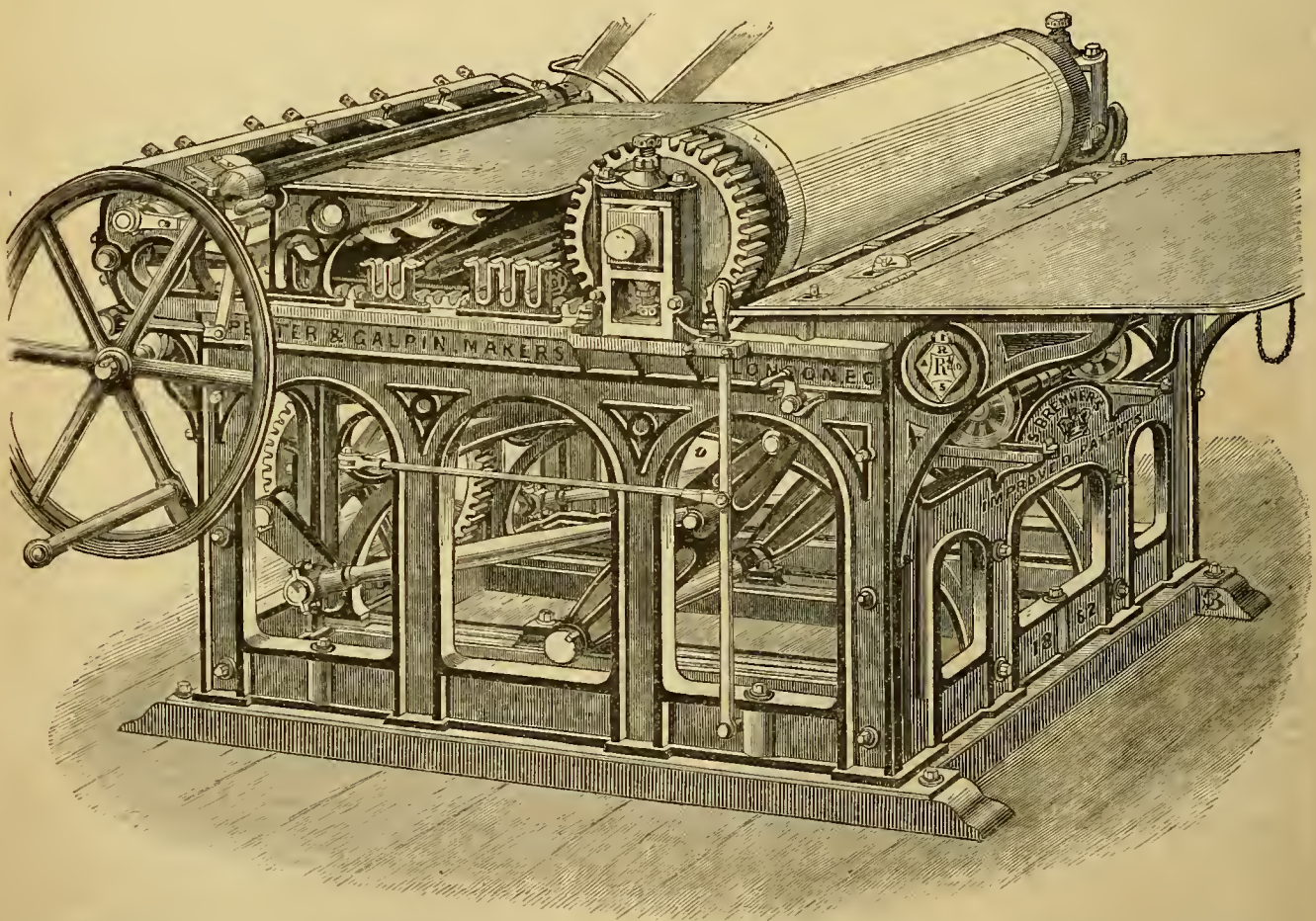
But how are you to burn your liquid eoals? We do not pretend to say definitively; if we eould do so, we should say it on parchment at the Patent Offiee; that is just the thing that tbe "eoming man" is to find out. But thus much we can say, that we *know* it is possible, nay, praetieable, without difficulty. At least, thirty years ago, the writer, then a lad, arranged the means of burning eoal tar, as the sole fuel for a ten-horse high-pressure engine, and for two or three years, the engine was wrought with perfeet ease with nothing else. It was diseontinued at last, simply because the priee of eoal tar at the loeality, which was at first next to nothing, was raised to a market value, by the establishment of a naphtha distillery at the plaee, and so the fuel, in result became then, dearer than eoal at 14s to 16s per ton. The arrangement was of the very simplest and rudest kind. What was done with eoal tar ean be done with tbe Ameriean eoal oil, or otber liquid fuel, and done far better than in the ease adverted to, where the supply of air was eold.—Ed.

THE IMPROVED "BELLE SAUVAGE" PRINTING MACHINE.

Mr S. Bremner, of the "Belle Sauvage" Printing Works, London, E.C., has worthily established his reputation for eylinder typographieal printing maebines, by tbe suecess which has attended his labours in tbis direetion. He has reeently patented some further improvements in tbis class of machinery, whieh deserve our speeial notiee. Fig. 1 of our illustrations represents a perspective view of Mr Bremner's latest improved machine. Fig. 2 is a longitudinal vertical seetion of a portion of the maehine, showing the mode of transmitting motion to the type table, and of loeking the eylinder. Fig. 3 is a detail side elevation of the break aetuating mechanism for checking the momentum of the eylinder before locking the same. Figs. 4 and 5 represent respeetively a detail side elevation and plan of the mode of working the "vibrator;" and figs. 6 and 7 are enlarged details, showing the mode of adjusting or regulating the height of the "vibrator," to compensate for shrinkage in the eomposition.

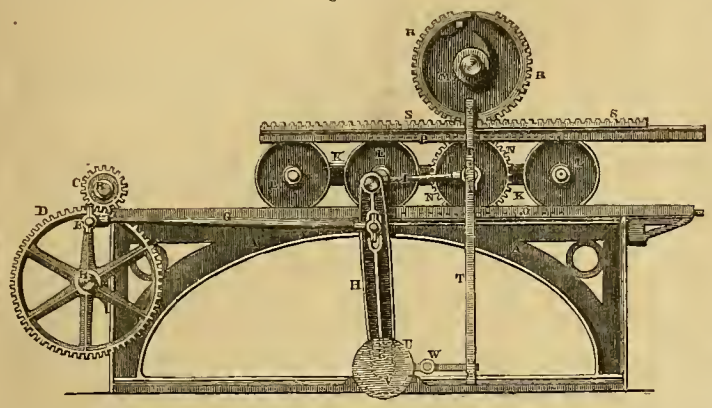
The main framing of the maehine is composed of east iron side and end standards of an elegant design, bolted together reetangularly, and having two inner frames or parallel bearing rails, A A, (fig. 2), bolted inside thereof. B is the main driving shaft, working in bearings bolted to one end of the main framing, and provided with a fly wheel, and fast and loose driving pulleys. C represents one of a pair of spur pinions keyed on to the driving shaft, and gearing into eorresponding spur wheels, D, fast on the seeond motion shaft, E, whieh works in bearings bolted to one of the end standards of the main framing. Each of these spur wheels is provided with a erank pin, F, as shown in fig. 2; or the eranks may be formed on the ends of the seeond motion shaft, as shown in fig. 1. To these eranks are jointed two eonneeting rods, G, their opposite ends being eonnected to slots in the two vibrating or roeking arms, H H, which are keyed at their lower extremities on to a roeking shaft, supported in bearings on the lower portion of the inner frames, A, whilst their upper ends are eaeh eonnected to a short link, I, jointed to tbe ends of one of a series of four axles, forming part of the earriage, K. This earriage is provided with a series of wheels, L L, running along guiding grooves formed on the surfaees of the frames, A; and upon the upper surfaees of these wheels runs the type table, M, which is grooved on the underside to reeeive the periphenes of the wheels. To one of the axles are keyed a pair of spur wheels, N, whieh run upon and gear with the borizontal racks, O, bolted to the inner sides of the frames, A, whilst their upper surfaces gear into corresponding racks, P, seeured to

Fig 1.



the underside of the type table. On imparting a vibratory or oscillating motion to the rocking levers, H, from the crank pins, the carriage will be caused to run to and fro along its guiding rails, and a rotatory motion will, at the same time, be imparted to the two spur wheels, N, by gearing with the racks, O, which rotatory motion will impart a

Fig. 2.



rectilinear motion to the type table, through the racks, P, which also gear with the wheels, N. By this combination of mechanism it is obvious that the traverse of the type table will be considerably augmented, being in fact double the throw of the upper ends of the lever, H, whilst at the same time the speed of the traverse will be greatly increased, thereby enabling smaller cranks to be used, and allowing of the driving shaft of the machine to be worked at a reduced speed, both of which advantages are of considerable importance in this class of machinery. The slots in the lever arms, H, where the connecting rods are jointed thereto, admit of the traverse of the type table being adjusted to the greatest nicety, as it is simply requisite to raise or lower the connecting point to vary the traverse of the type table. M is the impression cylinder; it is provided at one end with the ordinary toothed segment wheel, R, which gears with the rack, S, on the upper surface of the type table, for the purpose of receiving a rotatory motion when the table is passing under it, to make an impression, as is usual in printing machines of this description. A sliding bolt or catch, T, is used,

Fig. 3. Fig 4.

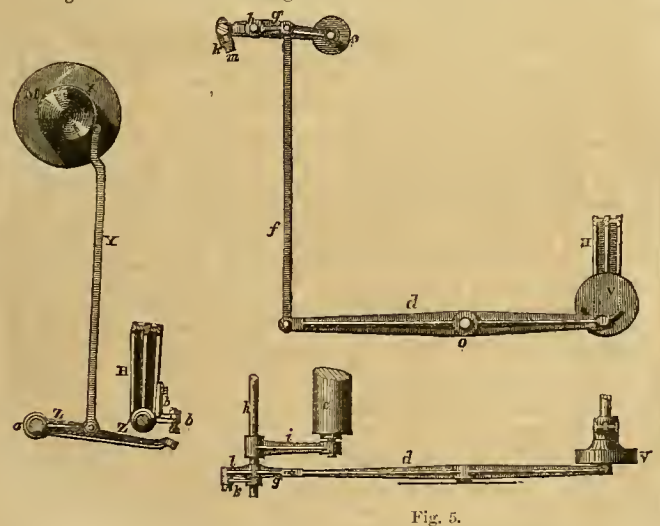


Fig. 5.

which is depressed so as to bring a tooth into a notch in the rim of the spur segment wheel, just as the "forme" completes its forward traverse with the printed sheet, and remains in that locked position whilst the "forme" is being run back again to receive the white sheet, consequently, the cylinder is held perfectly fixed or locked in its proper position during this movement of the type table. Just before the "forme" has arrived at the end of its back or return stroke, the tooth of the catch or bolt, T, is elevated or raised clear of the notch in the wheel, R; but the cylinder is still kept locked by reason of certain projections on the segment wheel, situate one on each side of the head of the locking bolt, and, consequently, preventing the cylinder from turning in either direction during the rising of the bolt; but as the type table continues to advance, the bolt, T, rises clear of the projections; and when the table returns with the white sheet, the elevated position of the catch or bolt, T, admits of the free rotation of the impression cylinder. Motion is imparted to the catch or bolt, T, at the proper times, by a rim, U, on the cam, V, keyed on to one end of the rocking shaft of the lever arms. This cam acts upon a lever, W, which gives motion to the vertical sliding bolt, T. Inclines are made on the projections before referred to, for the purpose of ensuring the return of the catch to its proper position again, should, by any chance, the cam not act properly, or in case the cylinder has become misplaced as regards the proper tooth in the rack, S.

In combination with this locking bolt, a break strap, X, (fig. 3,) is used, which embraces a break drum on one end of the cylinder. This strap is fixed at one extremity to the side of one of the plummer blocks which support the cylinder, whilst its opposite end is connected to a rod, Y, jointed at the lower extremity to a lever, Z. This lever works on a fixed centre, *a*, and is actuated or depressed so as to tighten and apply the break strap just before the bolt operates, by means of an adjustable screw fitted to a lug, *b*, screwed to the lower end of one of the lever arms, H. This screw strikes the end of the lever, Z, at each backward stroke of the lever arms, H, that is to say just as the "forme" arrives home with the printed sheet. An adjustable curved or inclined bracket, shown in fig. 1, is fitted to the top of one of the side standards of the main framing for the purpose of effecting the opening of the grippers at any desired part of the revolution of the cylinder. For carrying out this object a roller on the end of the arm of the gripper bar is made to run along the inner curved surface of the bracket, which has the effect of depressing or partially turning such arm, and of opening the grippers accordingly. By setting the curved surface nearer to or further from the cylinder or gripper bar arm, facility is afforded for regulating the opening of the grippers at any desired point of the rotation of the cylinder. *c*, Figs. 4 and 5, is the "vibrator," which is caused to rise and fall from and towards the inking table by the action of a cam on the second motion shaft of the machine, or by a lever, *d*, as shown in the woodcuts, which lever is centred at *e*, and is connected at one end to the rod, *f*, which is jointed to a lever arm, *g*, keyed on to the transverse shaft, *h*. This shaft carries also a pair of lever arms, *i*, which support the axis of the "vibrator," and cause it to rise and fall each time the lever, *d*, is actuated. Motion is imparted to this lever at the proper times by a cam groove made in the side of the cam, Y, on the rocking shaft hereinbefore referred to, a pin in the end of the lever, *d*, working in the groove of the cam. In order to compensate for shrinkage in the composition of the "vibrator," a means of adjustment of the lever arms which carry this roller is employed. For this purpose a slotted lever, *k*, (see side view and plan at figs. 6 and 7.) is keyed on to the shaft, *h*, by the side of another lever, *l*, which is loose thereon, and this loose lever is connected by a tightening screw with the slotter lever, *k*, the screw passing through the slot and entering the lever, *l*. By raising or turning the position of the screw in the slot by means of the adjusting screw, *m*, the height of the "vibrator" may be adjusted with the greatest nicety. Some of our readers who may be more particularly interested in this description of machinery may inspect Mr Bremner's machine now exhibited in the western annexé of the International Exhibition.

Fig. 6. Fig. 7.

THE ANNEALING TEMPERATURES OF METALS AND CRYSTALLIZATION PRODUCED BY VIBRATION.

IV.

So much for the crystalline system of aggregation of cast iron. Let us now proceed to *wrought iron*, under the guidance of the same fundamental law. When wrought iron, in any of the usual forms of its manufacture, is fractured, its molecular structure presents itself, more or less distinctly pronounced, in one or other of three forms, or reducible to their mixture

1st, The mass consists of minute crystals of nearly uniform size whose facets present themselves at all possible angles, like that of refined sugar. This *saccaroid* structure usually belongs to highly refined iron, and hard steely ones. Swedish *large* bars and Low-moor iron are examples.

2d, The fracture consists of large, sometimes very large, lamelar spangles or plates, facets of crystalline cleavage, whose planes or directions tend to general coincidence with that of fracture. The number,

size, and direction of these facets are found to vary in the same mass with the direction in which it is fractured. In all very large and heavy masses, such as great forgings, these planes of crystallization tend towards a general perpendicularity to the surfaces of external contour, i e., *they are upon the whole, found coincident in direction with the lines in which the heavy hammer strokes have been delivered upon the surfaces of the mass.*

3d, The fracture (hard to produce owing to the greater flexibility of the iron than in either of the preceding cases) presents long parallel *fibre*, or bacillary crystals running in the direction of the longest dimension (the length) of the bar.

This is the structure of the best rivet iron, etc., wire, etc.; it is only completely developed in small bars, best in small round ones. Large rolled bars present it mixed with the second form above, or *imperfectly* developed; and in very large masses it is never found developed at all

Now, at first sight it would appear that there can be no relation between this law of aggregation of wrought iron (manufactured in many different ways) and that of cast iron, as already stated, yet they are in principle essentially the same.

A mass of cast iron in consolidating from fusion is subjected to internal pressures of two natures only; (to fix our ideas, let us assume it a large cube); its internal pressures as it cools are—

1st, Hydrostatic pressure parallel to four of its vertical sides, greatest at the lowest side, and zero at the top one, or least at that. This makes the metal densest at bottom, and, *per se*, may have some tendency to induce (in this instance) a general horizontality of principal axis in the forming crystals; its effect on crystallization is small, however, and may be neglected, as being wholly overpowered by the other internal pressures, viz.,

2d, The contractile strains of cooling, greatest at the surfaces, and acting in planes parallel to the same.

In masses of wrought iron, the first set of strains (hydrostatic) are absolutely nill, owing to the viscidity of the mass in proportion to its size; but

1st, The contractile strains on cooling are in full force, the same as in cast iron; and we have in wrought iron, owing to the methods of its manipulation by rolling, hammering, etc, etc., a new set of internal pressures introduced peculiar to it, and propagated into the mass from the external pressures applied. These may be called—

2d, The internal strains due to working.

Now, the law of aggregation in wrought iron, is in fact the same as in cast, viz., "*In wrought iron, as in cast iron, the principal axes of the crystals tend to assume the directions of least pressure throughout the mass, while exposed to pressure and heat in progress of manufacture.*"

Let us take one example from the most strictly normal case—the 3d—the *lump* of wrought iron from which a round bar of rivet iron is about to be rolled, if we break it cold, will be found on the whole probably with large crystals, and these perpendicular to the surfaces on which it was struck, i.e., in the direction of least pressure within the lumpy mass as it was extended under the hammer, from the "puddle bars," or "pile;" these, however, *when the mass is large*, more or less modified by contractile strains, as it cooled.

The heated lump is now passed between the grooved rollers, under their prodigious lateral pressure it is squeezed thin, and elongated at a rapid rate to many feet in length. Heat is evolving from the bar all the time, and internal strains due to contraction are no doubt present; but they are inoperative, as respects the arrangement of the crystals, for two reasons—1st, The bar is all the time throughout hot, and *all* its parts as soft and flexible as wax nearly. 2d, The bar is relatively so small in two of its dimensions (thickness), in relation to its length, that contraction of cooling really only affects its length, and therefore affects its whole section equally.

Thus, the only internal pressures to which the bar is subjected are those due to the pinch of the rollers; but those pressures are all perpendicular to the length of the bar; or, in the case of the round bar, are in the directions of the radii of the cylinder. *The directions of maximum internal strains, therefore, are square to the external contour of the bar, and, therefore, the direction of least pressure is at right angles to this, or is coincident with the length of the bar, and this is the direction in which the principal axes of the crystals arrange themselves.* The same law as in cast iron, but acting within the mass, in a direction differing by 90°, and producing an exactly corresponding difference in effect as to direction of crystal.

Such, then, is the production of *fibrous bar;* but what is this fibre? for it bears no real similarity but in name, to fibre as seen in hemp, silk, wood, etc.

Let us recur to what has been stated as to the combination of crystallizability and malleability in metal, and we have the solution.

The crystalline axes of the original *lump*, from which the bar is to be rolled, are rapidly changed, and all becomes arranged under the first few squeezes through the rolls in directions parallel with the length of the lumpy bar, in obedience to the law already stated; but the principal axes, though thus already laid parallel, are *still short*, like the lump in which they are formed; but *every one of these crystals is malleable* and flexible—their length extends with that of the bar of which they form the mass; and as they extend their other dimensions become diminished, just in the proportion in which the motion of the whole bar is reduced; at last, the whole finished bar consists only of a *faciculus* of such capillary crystals, all having their principal axes of symmetry, laying the lengthway of the rod or bar, i.e., in the direction of least pressure within the mass.

The same phenomena are produced, by the pressure of the draw plate in wire drawing—upon the iron *cold*—the axes of the crystals in the fibrous iron wire, being just in the same way arranged and elongated in the direction of least pressure produced by the grip of the draw plate, but to these changes in iron *cold* we shall refer hereafter.

The heated thin rod or bar cools, but for reasons partly given already any internal strains, *now induced* within the bar by contraction, are incapable of modifying, by *new* internal strains at right angles to the former (rolling pressures), the crystallized arrangement already impressed upon the iron. The bar, therefore, if once fibrous, remains so when it is cold.

Not so, however, if the bar be very large and thick in proportion to its length, then the contractile strains of cooling become operative and may greatly modify or disturb the parallel or fibrous arrangement of crystals already produced by the roll. Suppose, for example, that a round bar of 12 or 15 inches diameter could (as there is no doubt it might, did rolling apparatus of sufficient power exist), be rolled out of a huge lump, so far as regards reduction of diameter as of the rivet rod—the big bar would be just as fibrous as the small rod when rolled—the pinch of the rolls in each case having been proportionate to the diameter of the small and large bar respectively, but when the large bar of 12 or 15 inches in diameter was laid down to cool—the *inequality* of its cooling—the greater coldness of its surface than of its interior and the unequal coldness of different parts (by evection) of its surface, &c., would give rise to enormous internal contractile strains within its mass. All these strains, however, would be greatest in planes parallel to its surfaces of external contour. The directions of least pressure *now* (within the still hot and partially soft mass, still susceptible of momentary fresh arrangements of its particles,) are in lines perpendicular to those same surfaces; and so many of the long bacillary crystals, again change their principal axes round the 90° and form planes and facets at right angles to the length of the bar. And this is the true cause why *a large rolled bar is never found, however good the iron, presenting an uniform fibrous structure throughout.*

The combinations of the forces we have described, with the effects of *still greater mass*, and of often great irregularity of form and of the many different directions in which the hammering or pressures have been applied, are the reasons why *large forgings are never uniformly fibrous*, and, indeed, when very large never fibrous at all. For mark another practical deduction that at once follows from our principles.

It is and must for ever remain impossible, to produce a regular mass of wrought iron of large size by any process of manufacture whatever—hammering or rolling, that *after it has become cold*, shall present an uniform fibrous texture, parallel with its longest, or with any one of its dimensions.

Thus, an armour plate 4 or 5 feet wide, 20 or 30 feet long, and 5 or 6 inches thick, might no doubt be rolled by proper machinery, so that as it left the rolls after the last "go through," its structure should be fibrous and parallel from end to end, the fibre being coarse, however, *i.e.*, the minor axis of the elongated crystals large, in proportion to the large size of the plate; but as this plate cooled, for the reasons given already, its fibres would become spontaneously altered to a great extent, and planes of crystallization formed in its mass at right angles to its edges and flat surfaces—and this must take place more or less whether the cooling be slow or fast; and so far from its being restored to fibre by annealing it, after it had become cold, any such second heating would aggravate all the effects of re-arrangement of crystals produced by the first cooling, the constraining forces brought into play being precisely the same in both cases, only in inverse order.

We stated at the commencement that Mr Mallet's "*principal axis*" of crystal coincides with the "*principal axis of elasticity*" of Fresnel. Observe how beautifully the result verifies itself as respects the fibrous bar or thin plate. Navier and Edwin Clarke have shown that the ultimate strength of the same iron, in the direction of its fibre, and transverse to the same, are, in round numbers, as—

20 : 17

and that the ultimate extension, of the fibrous bar or plate, in the line of fibre, is double (in round numbers,) that across the same.

The "work done," at rupture of equal sections in each case therefore is as,—

234·84 : 30·47

This represents the relative elastic power of the iron in the line of the principal crystalline axis to that in the line transverse to the same or

the relative elasticities of the crystals themselves in their orthogonal axes. An actual proof of the coincidence pointed out by Mallet between Fresnel's crystalline axis and his own.

We must, however, pass over many considerations that it would be important and profitable to pursue, and conditions that it would be desirable to explain, as respects this branch of our subject, and pass to the next—the third and last part of it, viz.:—The modifications of crystalline structures, and the limitations thereof, that can be produced in metals cold, i. e., at ordinary temperatures—limiting ourselves here to considering mainly wrought-iron—and the producing forces as mainly mechanical.

In the previous parts of this paper we sufficiently pointed out that mechanical force, producing extensions and compressions, i.e., constraining forces within the mass, and frequently and rapidly repeated, that is to say, vibrations—however long continued, or however rapid, produce no effects on metals, (e.g., wrought-iron) provided that the range of extension and compression be *far within* the elastic limits of the substance, and that the velocity with which the extension or compression is made, (as by an impulsive force) be not so great as to approach to or equal, the "pulse period," due to the material, i.e., the greatest velocity with which any force can be propagated through its substance.

It is a fact, however, that *instantaneous changes of molecular structure, and reversals or transpositions of the crystalline axes, can be produced in metals (again e.g. wrought iron) at ordinary temperatures* —and the conditions for such production are—

The applied force must be such as to produce distortion of the mass or of some part of it, beyond the elastic limits (of the material,) i.e., of the integrant crystals, having regard to the position of their "principal axes" in relation to the direction of the force applied.

We must, for brevity, again illustrate by examples—1st, It is a fact that such changes of structure can take place at ordinary temperatures. The common process of wire drawing is a proof of this. The slab, or bar of iron, from which a piece of fine piano iron wire is about to be drawn—when broken through cold, will be found probably to have a fine *saccaroid* fracture—it has *no fibre whatever*—it is pulled again and again through the draw place—the latter exercises an enormous grip upon its circumference, and an enormous *pressure transverse to the axis* of the cylinder, *the crystals arrange themselves normal to this*, i.e., in the lengthway of the wire, and as the latter elongates, they elongate with it. The iron has now become fibrous, that is, all its crystals have their principal axes—the axes of greatest elasticity, parallel with each other and with the length of the wire; and its elastic resistance to tension on the unit of section, has risen from say 30 tons per square inch of the original bar, to 90 or 100 tons in the wire—the change has all taken place *cold*. So also, if after the round rod of hot rolled rivet iron has got cold, it be now subjected to the further process of *cold rolling*, or of *wire drawing*, (for they are both in result the same) its elastic resistance will be found greatly increased. For this, there are more causes than one operative however, but into which we cannot now enter—suffice it to observe, that these changes are produced cold, or at ordinary temperatures; but what is there wonderful in this, if the change red hot be once understood?

Malleability is not a thing confined to a red or to any other heat, and lost *per saltum*. All bodies are more or less malleable, i.e., capable of having their forms distorted by suddenly applied pressures, at *all* temperatures, to this even ice, glass, the diamond, are no exceptions; though the extent of the producible distortion may in these elude our senses; but the metals are obviously, and to our senses, malleable at all temperatures, more or less. Iron is notably so. There is hence nothing stranger, nor any breach of analogy, in these changes of crystalline axis in iron, cold as well as hot.

But the force must be sufficient, to exceed the elastic limits of the material, it must produce some *permanent distortion*, partial or total; if not, the crystallometric equilibrium already existing within the mass is not disturbed, and no change whatever in its molecular arrangement results.

If the force be reiterated, and of such a character as to affect the mass of the material partially, i.e., to strain some portions of it much more than others, and that some be strained above the preceding limits, these molecular changes will result; but they will be insensible for a length of time, until at last the whole mass, altered bit by bit, has been weakened as a whole, by the disturbance of its crystalline axis, and at last it may break. Thus, a cannon, every time it is fired, has the interior surfaces or "couches" of the cylinder strained much more than any other part, and as a cannon is a machine, that *ex necessitato rei*, (in cast guns) is strained every time it is fired, to a large proportion of its total endurance, i.e., is a machine having a very small surplus strength, or factor of safety, so every cannon cast, must burst after a certain number of rounds have been fired from it. Again, a railway axle *may* break after it has run a certain number of thousands of miles, and received a certain number of thousands or of millions of percussions and vibrations, at the ends of meeting rails, &c.; but whether it ever shall so break or not, depends simply upon what excess of strength, we have given its weakest part, in proportion to the greatest percussive strains it has had to bear, if this surplus strength be such, that *no permanent distortion of any portion of its mass has been possible, no alteration whatever of its crystalline or molecular arrangement, shall occur, though it ran, and vibrated, and bent, for ever.*

But, *e converso*, strain by any force, either wholly external, as by the bending round in continually changing directions, of a railway axle, or by a force acting wholly from within, as in strains due to expansion or contraction *in use*, provided they be great enough, (as in the bars of common grates that after years of use get bowed inwards by the expansion of the side next the fuel,) or by a force from without producing some partial, or other internal strain; if the range be sufficient, *alteration of the crystalline axes may be produced instantaneously*, and to such a degree as to impair the cohesive resistance of the mass to a remarkable extent.

This fact is, perhaps, in no way rendered more remarkably in evidence, than by the common method by which a blacksmith breaks across a bar of tough fibrous iron, by simply "nicking" it cold, with a chissel with a very obtuse angled edge (about 90°) upon the anvil.

A nick thus made in the two opposite sides (nay, even in one side only) in a tough bar, say of 2 inches square—of not more than 2-10ths of an inch in depth—will so alter the nature of the iron at the spot, that a single blow of a sledge will cause it to drop in two, where 100 blows of the same (without the nick) would have failed to break it.

When a bar, however fibrous, is thus broken, the fracture is found not wholly, or perhaps even at all, fibrous; it presents crystalline plates and facets penetrating *across* the length of the bar, and diverging more or less from both faces of the wedge-like cavity of "the nick" into the substance of the iron. The fact, the process itself, is as old as iron bars and Tubal Cain almost—but no solution on scientific principles, nor indeed any attempt at solution at all, appears ever to have been made, until Mallet, in his memoir before referred to, explained its nature, and showed that it was only one case of the operation of his general law.

The obtuse chisel, driven by blows into the substance of the bar, compresses the iron, at and around both convergent surfaces of "the nick." The compression (if the nick be competent to admit of fracture) is sufficient to produce internal strains of compression within the substance of the bar, beyond the elastic limit (for the distortion is permanent), the directions of these interual pressures, are necessarily normal to the faces of "the nick," or to the sides of the chisel edge, that being driven in produces them; but being so, the directions of minimum pressure within the mass will be parallel to both faces of the nick, and principally in a plane passing down into the bar and bisecting the angle of nick. Now these are precisely the directions, in which the new formed plates and facets of crystals are found to be produced, viz.—transverse to the bar. The facets are "planes of weakness," and hence the bar easily now breaks with a blow, that would not have affected it before. They are planes of weakness, not only because it is probable that the crystalline faces of any crystalline solid do not cohere as powerfully as the integrant molecules of the individual crystal; but because the *breaking strain* is now *thrown upon the transverse axes* of the new-formed crystals, *which* are their *axes of least elasticity*, and from which cause *alone* the bar will now break across at the nicked point, by a force less, than at any other where it still remains fibrous, in the ratio of 23·484 : 30·47, as already explained. Thus, then, the sudden alteration of strength in the iron, is shown to be simply a change of crystalline arraugement, in obedience to the general law, that *whenever crystalline bodies are in act of having their arrangement of molecules changed, the principal crystalline axes arrange themselves in the direction of least pressure within the mass.*

Brevity in a necessarily long paper, and the practical character proper to this *Journal*, have compelled us to limit nearly all our statements and examples to iron. Mallet has, however, shown that his law of crystalline arrangement is quite general, and affects all material substances in the same way, though differently in degree. He has shown that the splitting up of a thawing iceberg into huge vertical prisms depends upon precisely the same play of forces that govern the breaking of the bar of iron. For all such matter we must again refer to his original memoirs.

We have been able, we hope, to give some clearness, to the much misunderstood notions of molecular changes due to vibrations. We have shown that mere vibrations, as such, have no effects different from any other motions of equal range or power applied; that *distortion of form*, partial or total, of the mass beyond its elastic limits, is the *sine quâ non* of molecular change; that if such occur, molecular change *must* follow; that the sort of change, *i. e*, the precise transposition of crystalline arraugement that shall be produced, depends upon the directions of maximum and of minimum pressure, induced within the mass, or of some portion of it; and that *time* is only an element in the question of change, at all, when at every instant, or at definite recurrent moments, *some distortion*, no matter how small, beyond the elastic limits recurrently takes place.

Some very loose and inconclusive experiments have been made some years ago, partly under Mr Fairbairn's direction, from which it has been most hastily and erroneously concluded that any pressure, however small, continued long enough, will overcome the passive resistance,

however great, of material substances—that a pillar of iron, capable of sustaining 20 tons for example, would, in the course of ages, bend or crack under a single pound. Were such a conclusion true in nature, although all Mallet's views as to crystalline arrangement would remain untouched by it. his final conclusions as to the intimate nature of crystalline changes possible. and due to strains in work, would become valueless; for *this* would be the illogical conclusion that must be arrived at upon admitting the above false dogma—that gradually, by any external force of pressure, however small, any mass of matter, however great, shall become weaker and weaker, by the mere fact of the presence of such force, and without any molecular or other change in the nature of the material whatever being produced. If this were true, the rock-ribbed "everlasting hills" must have long since crumbled into the plains; the pyramids would be ready to fall with the weight of the first set of men that topped them!

Mr Fairbairn's own more recent experiments, upon the vast number of times that a bar of wrought iron may be bent, within certain limits of flexure, and at a determinate velocity, without fracture, are, in fact, sufficient to overset these erroneous views. The latter have, however, got a currency amongst the great numbers who, as Locke said, "are content to beg their knowledge with another man's alms basket," and to echo what they have heard "in verba magistri," without a thought of their own, whether it be a truth of nature, or some distortion of her fair image. —Ed.

INTERNATIONAL EXHIBITION—THE ZOLLVEREIN DEPARTMENT.

For the following notices of Class I. of the Zollvercin in the great Exhibition, we are indebted to the pen of a distinguished correspondent, himself a Prussian, and intimately acquainted with the products and powers of Germany.

The Class I. of the Zollverein Department in the International Exhibition—containing mining and metallurgical products—is, with some exceptions, composed of specimens produced by Prussia.

We at first propose to treat of that country. The specimens exhibited are not arranged in single groups, following the exhibitors, but form one large collection, being only classed into three divisions, after the three large mining districts of Prussia, namely, that of Rhenish-Prussia and Westphalia, that of Silesia, and that of Prussian Saxony, out of which the products of the united mining districts of Rhenish-Prussia and Westphalia fill nearly three-quarters or more of the whole collection.

Before we go on to some further details, we must give some account of the origin of this collection. The owners of mines and smelting works united themselves to contribute to it, and perhaps this union is the more remarkable, as it was only possible thus to form a collection of an extent, which has not been equalled in this manner before in any exhibition, and is the more astonishing, as the exhibitors gave up their individuality for this purpose. There are large works which have exhibited not only coal and coke, but iron-ore, lead-ore, pig-iron, silver, etc., but who, notwithstanding, permitted their products to be separated to different places. Mr Von Dechen, of Bonn, has the great merit of having directed this arrangement, and his commissioner, Dr Widding, undertook, in travelling through the country, to collect or select the specimens approved by the exhibitors for the Exhibition. In consequence of that, only those specimens have been allowed which seemed most suitable—all being declined which were too large, following the view that the structure and quality of each material will be seen sufficiently in a specimen of a certain magnitude by every skilled person, immense blocks are not wanted; further specimens of an uncommonly rich character, or of extraordinarily fine structure of crystals, have not been selected, with the view that the Exhibition, first, shall not show how it could be, but how it is; and second, that the collection shall not be a mineralogical one, but a technical one. The metallurgical products show not only the metals produced, but also the by-products or educts, as cinders, slags, etc., so that the process carried on in the different works can easily be judged.

In the same manner the collection of Prussian Silesia has been arranged, but on a much smaller scale; whilst only a few exhibitors have contributed to that of Prussian Saxony. From the other countries of the Zollvercin, only Nassau, and to some extent Hesse, produce similar collections. All others have limited themselves to single specimens.

We only purpose to give here a general view of the things exhibited, and refer for detailed study to the special catalogue, which is just published, and separate, for this Class I. of the Zollvercin department.

The collection begins in the middle of the south wall of the room, showing to the right hand side the Rhenish and Westphalian, to the left hand side the Silesian products. The fossil fuels begin the range—at first the coal. The different basins are separated and arranged in their order from west to east. In each basin there are represented the most important seams, or groups of seams, so that the first specimen shows the lowest; the last one the uppermost seam. The coals of each basin are followed by a series of the intermediate rocks, which show their different compositions—as clay or shale, sandy shale, sandstone, pebbly rock, and also ironstone, that very remarkable phosphoric shale (phosphorschiefer), alumshale, and so on. These rocks, again, are followed by the dressed or washed coal, and the cokes made of the coal of every basin. Four large blocks show the natural composition of coal seams at Saarbrucken—they are erected near the two entrances, and we mention, with regret, that one of nearly the height of the room was broken by accident in erecting it. Brown coal, and the products made from it, close the range on that side of the room.

Iron ores begin in the northern part. They are arranged at first after the age of the formations in which they occur, beginning here with Devonian, closing with Alluvium. In each formation they are arranged after the composition of the ore, thus, for instance, spathose iron, red, brown, clay, iron ore. The Devonian group is the richest and most important, the spathose iron being particularly celebrated.

At a small staircase, near the iron ores, is shown the products of pig-iron works, and we cannot neglect to draw the attention of visitors to the very fine specimens of lamellar pig-iron, which is used particularly for steel-making in the country of Liegen, and produced from the spathose iron ores, occurring so very frequently here in lodes. Then we would mention some castings in the front of the large passage in the middle of the room, made directly from the blast-furnace, and also a very extraordinary spiral casting, also directly from the blast-furnace.

Products of rolling mills, wire, plates, etc.—in short, wrought-iron and steel, are arranged partly on the opposite staircase, partly on small stages between the two, and it is scarcely necessary to direct the attention of visitors to the beautiful fractures of rails and other things, the bent and punched specimens of iron, and the large collection of different shapes of bridge, and edge-rails, T iron, etc. But of great interest are the bent axle of 5-inch diameter, and the broken pile of a railway axle.

Returning to the principal staircase, we find the iron ores followed by lead ores. They are arranged in the same manner—after the age of the formation in which they occur. Again the Devonian group is the richest; but not less worth attention are the lead ores from the Bunter beds, which occur in a very thick layer, near the surface, at Commorn, in the Eifel mountains. The products of dressing the ores are shown in bottles, but more of them are to be seen under the range of copper ores.

Specimens of bird shot and white lead paints are to be seen in a separate case in the southern side of the room. The other products of lead works are to be found on the small staircase, together with the clays, slags, &c., and also the silver reduced out of the lead.

The following ores are those of zinc; and here we are bound to mention particularly the products of dressing, which show the excellent separation of lead and zinc ores by means of mechanical processes. Works in zinc are again to be seen near the lead works on the small staircase, but show no great extent.

Under the copper ores there are the remarkable carbonates of copper, which belong to the coal measures, containing an average only 1 per cent. of copper, but, notwithstanding, used with very good success, by treating them by the wet process, with mixed sulphuric acid and muriatic acid, and the so-called mother-ley of green vitriol, which products and by-products are exhibited on the small staircase.

The following group unites the ores of nickle, cobalt, antimony, manganese, &c., also iron-pyrites, which is used now in large quantities for making sulphuric acid. The metals from these ores, particularly antimony, nickel, and cobalt, are in the front part of the small staircase, and worthy of special examination.

Here close the ores and the products from them, which belong to Rhenish Prussia and Westphalia. Building stones form the next group, then roofing slate, excellent in quality and polish, marble, beautiful by its colour, and some other materials used for cement, &c. But we must here mention also the large mill-stones from Niedcomendig, far celebrated, and exported in great quantities to America and other continents.

We now proceed to Silesia. The coal, ores, and rocks, particularly granite, are arranged in the same manner, but the metallurgical products chiefly attract our attention, particularly the fine collection of iron fractures. The iron ore in Silesia is commonly very poor and difficult to work; the broken railway pile, and the different rails, round iron, &c., show the quality. Two hardened rolls of chilled iron are placed in the middle of the room, bright as silver. Other metals are to be seen, the smaller products being united on the little staircase. Here are different sorts of arsenic products, and the gold produced from the residua; here are beautiful

zinc specimens, and the rare metal of Cadmium to be seen. Large zinc plates, two said to be the largest made in the world, are placed on the wall, and behind the large copper vessels. The corrugated zinc plates show a high degree of perfection. We mention, lastly, a large quantity of cubic nickel.

From Prussian Saxony, the chief products of which are placed on the opposite small staircase in the southern half of the room, excepting some building stones, the most remarkable products are those of the Mansfield Copper Company, which show not only all the copper, silver, and nickel products made at their works, amongst which particularly are five large copper cauldrons, plates, &c., which are placed in the middle of the room, but also a very remarkable product, seldom to be seen in such quantities, namely—Selenium, and the raw material for making it.

Here we cannot omit the products of brass and yellow copper, which are exhibited by the royal Messingwerk, and which are to be found in front of the large zinc plate.

The products of brown coal of that mining district, containing paraffin, and different oils, are exhibited in four glass cases, easily seen near the principal passage.

The rock salt from Stapfurth is exhibited in the shape of a large obelisk, and near it are the other salts which accompany rock-salt, to be found on tables of the same material. Both are of great importance, the rock salt stratum being one of the richest treasures of Prussia by reason of its purity and thickness, the other salts obtained with it being of great value for agricultural purposes.

Lastly, we may mention that two waggons for mining purposes, showing a number of ingenious inventions, which belong to this class, are exhibited in the machinery room, and likewise a set of wheel tyres.

A large sandstone block is to be found in the second room from that of Class I.

From the other countries of the Zollverein there is worthy of being mentioned particularly the small but very fine collection of Napau, arranged after the above principles. The ores of Manganese especially; and amongst the rocks, the roofing slates can bear every competition.

From Hesse we call attention to the collection of Mr Casche—a very small, but very well-selected one.

From the kingdom of Saxony the tin and the marble are most worthy of attention. From Bavaria comes an enormous slab of lithographic stone, and also a very rich phosphorite.

But not the least ornament of the whole collection are the maps, belonging to Prussia. We cannot go into any detailed explanation, but their examination will facilitate very much the study of the collection. There are not only general geological maps, but also sections of single coal fields, plans of workings in collieries, all constructed with great carefulness and accuracy. The maps of Rhenish Prussia and Westphalia by Mr Von Decken, the map of the coal measures of Upper Silesia by Mr Huyssen, the sections of different beds of Prussian Saxony, particularly the coal measures near Halles, and the rock-salt stratum of Stapfurth, are worthy of special attention, and also a set of maps showing the structure of the coal formation at the pits of Westphalia, and a set of maps showing the like for the coal fields of Sude and Worms as of Saarbrucken.

HOLLAND AND PAYTON'S BREECH LOADING SPORTING GUN.

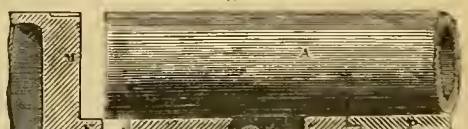
We have seen many attempts, more or less perfect, at producing a really simple and efficient breech-loader for the field, but in none have we been able to discover that peculiar combination of absolute simplicity and effectiveness which we find, by personal experience, in Messrs Holland and Payton's gun. Fig. 1 of the engravings represents a side elevation of a portion of the improved breech-loading smooth bore gun; fig. 2 is a longitudinal section of the same; and fig. 3 shows the details drawn to an enlarged scale. A represents one of the barrels, and, B, B^1, projections forged on the under side thereof. These projections work in a slot or opening in the seat piece, C (fig. 2), and the front one, B^1, is pivotted at its front end to the same by an ordinary pin or pivot, D, entering a slot, E, in the front projection, as shown in fig. 2, to admit of the barrels moving longitudinally. F is a slot or opening made between the two projections, such opening or space being situate between the pivot, D, or centre of motion of the barrels and their breech ends; within this opening, F, works a cam or lever, O, in one piece with the pin, H, one edge of which cam is curved at *g*, concentrically with the working centre or pin, H, of the cam or lever. I (fig. 1), is an external lever arm or handle, secured to one end of the pin, H, and serving to turn the same when opening or closing the breech. The pin, H, works in the cheeks, C, and in order to facilitate its removal a small block having dovetailed flanges inserted into a corresponding groove in the top of one of the cheeks, is used. The pin, H, passes through this block, and the whole is free to be slid out latterally when the holding screws are withdrawn. K is a projection on the front of the breech piece, M, having a piece of steel, L, applied thereto, inserted from the rear of the breech piece. This projection, K, fits into a notch, k^1 (fig. 2), made in the rear end of the projection, N, underneath and between the two barrels, and serves to lock the barrels in their places when the breech ends are closed. The curved edge, *g*, of the lever or cam, G, works against a correspondingly inner curved surface on the projection, N, as shewn, and when in that position it maintains the barrels firmly against the breech piece, M. On turning the lever or cam, G, in the direction of the arrow, fig. 3, its edge, *h*, acts against the forward end, *i*, of

Fig. 1.

Fig. 2.

the opening, and pushes the barrels lougitudinally from the breech piece, so as to disengage them from the projections, K, L, during which movement the curved edge, *g*, bears upon the bottom, *k*, of the opening, and keeps the breech ends of the barrels down upon the seat piece until their disengagement has been entirely effected; this arrangement preventing all play or shaking of the barrels, even after the breech has become disengaged. The continued rotation of the cam or lever, G, causes its curved edge, *g*, to leave the bottom, *k*, of the slot or opening when the weight of the fore part of the barrels controlled by the motion of the corner, *l*, of the cam upon the bottom part, *k*, of the slot or opening, F, causes them to turn on their pivot, D, thereby effectually exposing the breech of each barrel, as is clearly shewn by fig. 2, when the cartridges may be inserted with facility. For the purpose of closing the breech again it is simply necessary to bring back the cam or lever, G, to its original position, in doing which it will first press upon the bottom, *k*, of the slot or opening, thereby depressing the breech ends of the barrels down upon their seat piece, and will then force them lougitudinally towards the breech piece, so as to lock them under the projections, K, L, this latter motion being obtained by the action of the corner, *l*, of the cam or lever, G, against the straight portion at *m*, of the back end of the slot or opening, F, the curved part, *g*, finally entering the corresponding curved part of the projection, B, and firmly holding the barrels in their closed position. Any suitable snap catch being used to fix the external lever, I, in the position seen in fig. 1, and so prevent it accidentally turning down. By simply withdrawing the pin or bolt, N, the fore part, O, of the stock, with the tail, P, which forms the bottom of the slot or opening, F, may be removed by sliding it forward slightly, so as to detach the stepped end, *p*, of the tail from its notch in the bottom of the projection, B, at the same time detaching the projection, *a*, from the notch in the front part of the projection, B^1, and disengaging that portion, *r*, of the fore part which is stepped under the stop piece attached to the barrels, and in which the pin, N, slides. The barrels may now be detached from their pin or pivot, D, the whole of the parts being thus easily accessible for the purposes of cleaning, oiling, or repairs.

Fig. 3



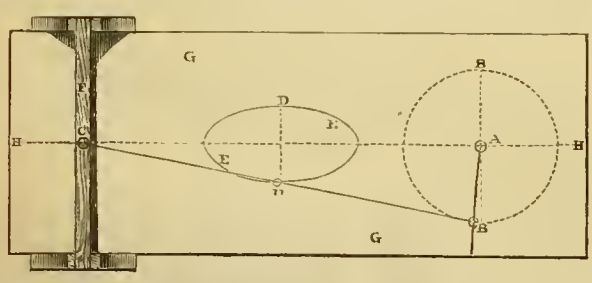
These gentlemen have also introduced some striking novelties in military breech-loaders which space will not admit of our illustrating. In these weapons an external screw thread is formed on the breech end of the barrel, and a collar is applied thereto, provided with a suitable lever handle to facilitate the turning thereof. This collar is slotted on one side, such slot correspouding to a similar slot in the breech end of the barrel when the lever is raised to open the breech. A suitable piston

or plunger fits at one end into the breech chamber, and is provided with a rib or projection on one side, which is withdrawn from or inserted through the coincidiug slots above referred to; the stem of the plunger lying in a semicircular grooved or channelled piece fitted in the stock and in a line with the barrel, the front part of such piece of metal being made to overlap slightly the screwed collar above referred to, so as to keep the barrel in its place. In charging the gun the collar is turned partly round so as to bring its slot in coincidence with the one in the breech, when the plunger is free to be withdrawn, leaving an opening in the upper side of the channel for the introduction of the cartridge, which is now forced into the chamber in the breech by the front end of the plunger. The plunger is locked in its place immediately behind the cartridge by turning down the lever again, so as to restore the collar to its original position. When the breech is open the lever will always be in such a position as to prevent the hammer from falling upon the nipple. In lieu of the collar and grooved or channelled piece in the stock being separate and distinct, it is proposed in some cases to combine a tube with the collar, the two being made in one piece, and the tube being slotted on one side to admit of the insertion of the charge. When closed, this slot in the tube will lie underneath upon a semicircular bed of metal let into the stock. A plunger, somewhat similar to the one above described, works inside the tube for the purpose of forcing in the charge and forming the moveable breech. The rear end of the tube is inserted into a collar fixed to the stock, which collar is slotted on the top side to coincide with the slot on the breech end of the barrel. A projecting rib or feather is fitted to or formed along the entire length of the piston or plunger, which slides in the slot of the stationary collar when it is inserted and withdrawn; when the piston is withdrawn its feather will fit partly in the slot in the tube and partly in the slot in the fixed collar, consequently the piece cannot be fired until the piston is pushed into the proper place, and locked safely by turning down the lever. The piston is so made that the hind part will be free to rotate, whilst the front portion remains locked in the barrel. This form of breech-loader is particularly applicable for converting muzzle-loading fire-arms to breech-loaders.

MACHINE FOR CUTTING OVALS.

A simple machine for this purpose has been invented by Mr Robert McAllister, of Island-bridge, near Dublin.

The instrument consists merely of a board with two or three mahogany bars with pivots, and a cutting tool of simple construction, for cutting out the ovals in card or wood. A diagram is annexed. A is a fixed centre, round which the point, B, revolves; *c* is a parallel slide, moving in the centre line, H H; D is a point in a connecting bar joining the points, B C; F, parallel sliding plane; O, the board. Now, if the point, B, be made to revolve round its centre, A (the point, *c*, also in motion), any point, say, D, in the connecting bar, will describe an ellipse, *c*, whose major axis is equal to the distance, B B, and whose



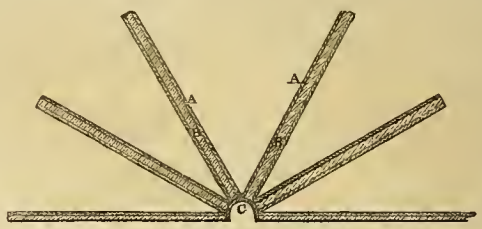
minor axis is equal to D D. The inventor says, I have not seen this problem in any geometrical work. As a draughtsman I find the instrument of very great service. It suits well for making moulds of concentric ellipses, which can be made from one inch to twelve in length, or longer if necessary.

RECENT PATENTS.

PHOTOGRAPHIC ALBUMS.

T. J. Smith, *London.—Patent dated July* 12, 1861.

In Mr Smith's improvements upon that modern device, the "photographic album," the leaves are made of parchment, textile fabric, or paper mounted upon a textile fabric—such materials being more durable, and less liable to be torn by the insertion and removal of the photographic pictures than the paper or cardboard hitherto employed in the manufacture of the leaves of books for this purpose. In addition to the advantage of greater strength and durability, a further advantage arises from the use of the materials above mentioned, inasmuch as the sewing or stitching of the leaves when binding the album is entirely dispensed with, there being sufficient strength in the leaves to admit of their being simply glued to the back piece. The mode preferred in making these albums is to paste or cement a sheet, A, as shown in the accompanying diagram, of parchment, vellum, textile fabric, or paper mounted

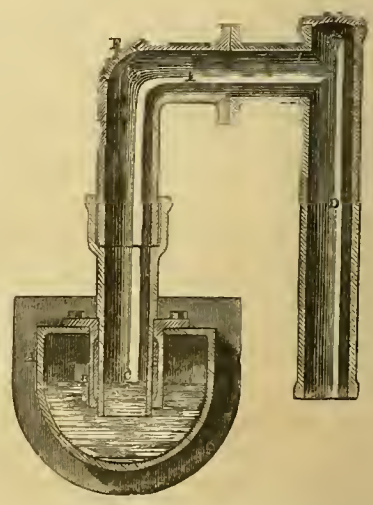


upon linen, over the two contiguous faces of any two of the leaves—the body, or inside part of such leaves being composed of cardboard, as at B, indicated by dotted section lines, and cut out in the centre, to allow for the thickness of the photographs in the usual manner. The series of leaves being thus united at C, by the cementing of the sheets, A, thereon, are glued to the back piece, which it is also preferred to make of linen, or other strong textile fabric, and thus the necessity for sewing is avoided.

GAS APPARATUS.

Henry and Francis C. Cockey, *Somerset.—Patent dated September* 25, 1861.

This invention has reference to a peculiar arrangement connected with those parts of the apparatus employed in the manufacture of gas for lighting and other purposes, known as the "dip pipe" and "hydraulic main;" and its object is to allow for the contraction and expansion, or rise and fall, of the ascension pipe, and thereby to prevent the strain upon the joints of those pipes, and upon the mouth-pieces of the retorts. According to this invention, it is proposed to fix in the hydraulic main a short flange pipe sufficiently long to give the necessary seal for the dip pipe, and this pipe is bored out, so as to allow the dip pipe to pass through it. The outside of the dip pipe is turned to fit the short pipe truly, but allowing it space to shift easily through it as the ascension pipe expands or contracts. In fixing the pipes, the lower edge of the dip pipe should extend about a quarter of an inch below the outer flange pipe.



The subjoined engraving represents a vertical transverse section of the hydraulic main with these improvements applied thereto. A, is the hydraulic main, and B is the short flange pipe projecting therein, and dipping into the water of the main, so as to seal the pipe. C, is the dip pipe which passes freely through the short pipe, B, so as to be capable of rising or falling therein as the ascension pipes, D, expand or contract. A door, E, is fitted to the upper part of the dip pipe, for facilitating the cleaning of it, and of the branch, F, leading to the ascension pipe.

PERMANENT WAY OF RAILWAYS.

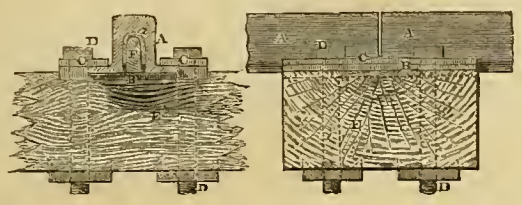
James Price, *Dundalk.—Patent dated September* 23, 1861.

This invention relates to a new and peculiar system of forming the joints of ordinary bridge rails, or other flat-bottomed rails employed on railways, applicable either to new lines, or to existing lines where such rails are employed. According to this invention, it is proposed, in

forming the joints of bridge or flat-bottomed rails, to employ a wrought-iron chair of a sufficient width to contain the flanges of the rail, and receive the fastening bolts which secure the chair to the sleeper, such bolts passing through the chair, but not through the flanges of the rail, the edges of which they touch or nearly touch when in their places.

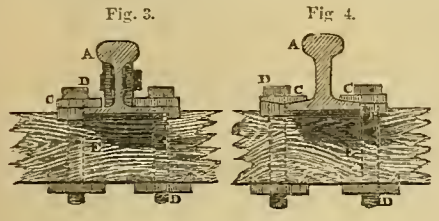
Fig. 1 of the accompanying engravings represents a side elevation of one arrangement of the improved form of joint as applied to bridge rails,

Fig. 2. Fig. 1.



and fig. 2 is a corresponding cross section of the same. A are the abutting ends of the bridge rails, having their joint in the centre of the length of the trough-shaped chair, B; and into the trough of which the flanges of the rails, A, are fitted, with a holding-down washer plate, C, bolted down upon the top of each side of the chair, and projecting over the flanges of the rails. The bolts, D, which pass through the washer plates. C, the thick portions of the chair, and the sleeper, are screwed into large nuts on the under side, which serve to hold the whole of the parts firmly together, and to secure them down upon the sleeper, E. To insure perfect contact between the washers and the flanges of the rails, the outside portions of the chairs, where they touch the flanges, do not rise quite as high as the top of the flanges, but slope upwards to that height at the extreme outer edges. A wooden dowel, F, which is driven into the hollow of the two bridge rails at their abutting ends, may or may not be protected on the upper surface by a sheet iron plate, *a*, bent over it before being inserted into the rails. This dowel may, if desired, be dispensed with in this system, as the flanges which fit the trough of the rail serve to keep them in the true line, but still it is preferred to use it in combination therewith. Fig. 3 represents a transverse section of another system of securing the rails down upon their sleepers, as applied to the ordinary fish-jointed, T-headed, and flat-bottomed rails. As the chairs in this case are not used as joint chairs, but merely as intermediate chairs, it is only requisite to have one bolt hole in each side thereof, and to have both the chairs and washer plates much shorter than in the first modification shown in fig. 1. But when the joint is not formed by fish plates, and a broad sleeper is placed at the joint, then the joint chair, shown in figs. 1 and 2, is to be used for this form of rail, also, as before described, in reference to the bridge rail, with chairs and washer plates of a corresponding length. Fig. 4 shows a transverse section of a similar rail to that shown in fig. 3, but having the upper surface of its flanges inclined, in place of horizontal, in which case the outside portion of the chair may be raised at the outer edge, so as to form one inclined surface, corresponding, or nearly so, to the incline of the top surface of the flange, the under surface of the washer plates being found to correspond with the inclined surfaces of the chair and flange; or the chair may remain unaltered in shape, and the under side of that portion of the washer plates which bears upon the inclined surface of the flanges only need to be inclined or bevelled, both of these ways being indicated in this figure. Cross sleepers alone have been described and shown in the engravings, but the arrangements are all equally applicable to longitudinal sleepers.

Fig. 3. Fig. 4.



REMOVING AND PREVENTING DEPOSIT IN BOILERS.

J. H. Johnson, *London and Glasgow* (J. Harrison, *Philadelphia, U.S.*) —*Patent dated October* 23, 1862.

The object of this invention is to remove and prevent any deposit or accumulation of mineral, chemical, or other substances, in steam boilers and other vessels liable to such deposits, and this is carried out by means of apparatus arranged for the purpose.

In carrying this invention into practice, there are arranged in the interior of the water space of the boiler any convenient number of rotating screws or vanes, which are either rotated by the circulation of the water and the ascending steam bubbles, or by suitable mechanical contrivances moved from the outside of the boiler. In order to prevent any matters from becoming deposited upon the surfaces of the boiler, and to keep such matters in a state of agitation and suspension in the water, so that by frequent "blowing off" the water in the boiler, and the sides of the same, may be kept perfectly clean; in the water spaces surrounding the fire box of locomotive boilers, it is proposed to apply a number of rotating arms or "spiders," fitted loosely on to any desired number of the stays, and provided at their outer ends with cups or chambers, so that the bubbles of steam will be collected within these chambers, and by their ascent will cause the arms or "spiders" to rotate, and thereby remove any deposit forming on the sides by rubbing in contact therewith.

Fig. 1, of the subjoined engravings, is a vertical section of one of the units of the improved steam boiler, referred to in the specification of a patent granted to the patentee of this invention, on or about the 30th of August, 1859, No. 1970. In the centre of the unit, A, is placed a cast-iron, or other metal, screw or spiral, B, which is kept in a central position with the unit by the bolt, C, used for holding the units together. This spiral may either be inserted in sections so as to be removed at pleasure for cleaning, or it may be cast inside the unit by inserting it in the body of the core. The outer edges of the threads of the screw are made to conform to the inside shape of the unit, leaving sufficient space for clearance at its outer diameter and around the central bolt, C, as will allow the screw always to turn freely on its axis in the manner hereinafter described. The action and object of this arrangement is as follows:—When steam is being actively generated in the boiler, a violent current of steam bubbles and water passes in the direction of the arrows upwards from the heating surface, and in doing so the screw will be constantly turned on its axis, which, by its nearness to, or occasional touching the inside surface of the unit of the boiler, will remove or prevent any great amount of foreign matter from collecting or being deposited thereon. In placing a number of the units together in a vertical position, or on any angle of inclination, it is proposed to connect the screws at the ends by suitable couplings, thus compelling the screws in the whole column to turn together, and in this way the lower parts of the boiler, where there may be but little circulation, are kept clean, as well as the parts most actively engaged in generating steam. The upper screws will have power enough to spare for operating the lower ones, where the latter might possibly lack power to turn themselves if the screws of each unit were turned separately.

Fig. 1.

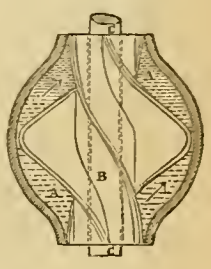
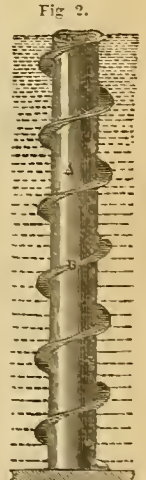


Fig. 2 represents a vertical tube, as frequently used in marine boilers, surrounded by water, the heat in this case passing through the tube. Around the tube, A, as high up as deposit may collect, is placed a metal spiral, B, as shewn in the engraving, just as much larger inside than the outside diameter of the tube as will enable the spiral to turn at all times freely around the tube, its weight being supported by a suitable bearing either above or below. It is obvious that when steam is generated actively around the external surface of the tube, the spiral will turn with the force of the ascending current, and it is equally plain that in turning round the tube, the spiral will remove or prevent almost entirely the deposit of any matter upon the outside surface of the tube. The tubes in this case must be sufficiently wide apart to enable these spirals to be introduced, and this may cause a diminution of tube fire surface, but the conducting properties of the tubes will be so greatly improved by being kept much cleaner, that this will go far at least to compensate for any loss of surface in the tubes. The same principle is applied to the inside of a tube, A, when the water for generating steam is inside thereof. The action of the spiral, B, in this case, when supported by, and turning upon a pivot at each end, whether placed vertically, or at an angle, or even horizontally, is the same. But when placed horizontally, the spiral must be arranged so that the currents of steam or water escaping from one or both ends of the tube tend to turn the spiral throughout its whole length, and will thereby prevent the inside of the tube from being coated with any serious amount of deposit of any kind.

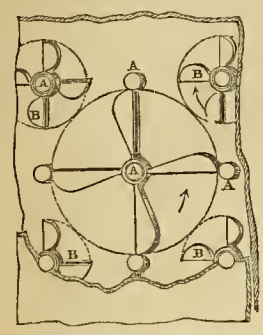
Fig. 2.



Figs. 3 and 4 represent respectively a perspective view and plan of an arrangement as applied to the prevention and removal of deposit

in the water spaces of ordinary boilers, whether marine, locomotive, or stationary. In this arrangement the stay bolts, used for strengthening the sides of the water space, are shown at A, as usually arranged. On some of the stay bolts is placed a series of "spiders," B, each "spider" being provided with three or four, or other number of arms of equal lengths. At the outer extremity of each arm a chamber is formed of such size as may be needed. These chambers being placed so as to collect within themselves the bubbles of steam rising in the direction of the arrows, and on the principle as hereinbefore explained, cause the "spider" to revolve round the stay bolt as its centre. These "spiders" are made so wide as cause them to nearly touch from the stay bolt to their outer extremity against the plates on each side of the water space, and thus, by constant turning and rubbing against the deposit that may be collecting, or against the plates themselves when the boiler is in action, will prevent or remove any deposit that may collect on the fire surface forming the water space. By suitably arranging the sizes of the "spiders," as show in fig. 3, a very small portion of the plates forming the water space will remain untouched. All these "spiders" will be in constant motion when the boiler is at work. It is not contemplated that any serious difficulty will occur from deposit collecting thereon.

Fig. 3.



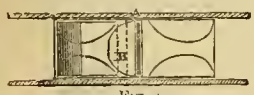
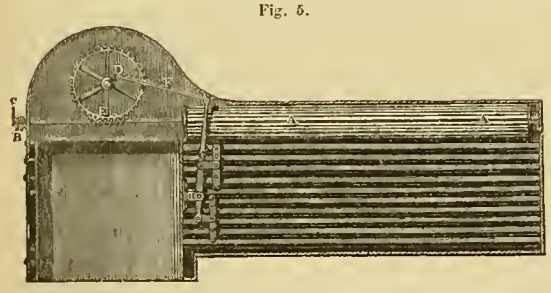


Fig. 4.

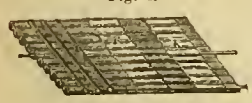
According to another mode of utilising the force obtained by the rising bubbles of steam for the same purpose as hereinbefore described, and which is particularly applicable to locomotive and other boilers as now constructed, there is placed above the tubes, partly in the steam space at the top of the boiler, a long wheel, A, fig. 5, immersed as deeply

Fig. 5.



as possible in the water. The shaft of this wheel is supported at the ends and turns freely, one end of the shaft passing through a stuffing box, B, to the outside of the boiler. On the external end of this shaft is placed an index hand, C, to show whether motion is going on or not inside, or as a means of driving the apparatus by mechanical power applied to the outside of the boiler. The steam, as it is generated in the boiler, in rising through the water collects on one side in the inverted troughs forming part of the wheel, A, which, being lightened by the displacement of the water previously filling the troughs on that side, is made to turn upon its axis, as in some of the previously described arrangements. The force acquired by the revolutions of the wheel is conveyed to a crank, D, by means of a worm and wheel at E, such crank having connecting rods, F, attached thereto, and these rods being attached at their opposite ends to a lever, G, and other apparatus, shown in the drawing, whereby, when the wheel, A, revolves as above described, motion is given to the lever, C, which, vibrating on its fulcrum, H, moves a series of ranges of transverse rods, I, or of wire gauges, or perforated metal plates, K, shown more clearly in the enlarged perspective view, fig. 6, placed between and on the tubes, and thus by their constant movement to and fro when the boiler is in action, deposit will be prevented almost entirely.

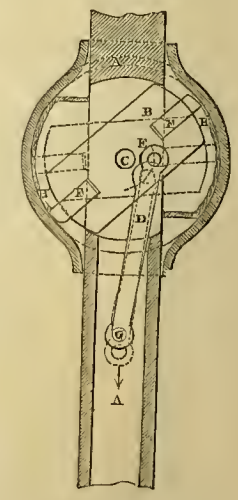
Fig. 6.



Another mode of cleaning and preventing deposit in a horizontal boiler, or one placed nearly so, having a circular section at the part to be operated upon, consists in making use of the rising bubbles of steam to give motion to a set of arms revolving inside it; and, in addition to the mechanical action of these arms, loose pieces of flint or other substances are placed in each circular part of the boiler. These loose pieces of flint or other substances would of themselves tend, in a great degree, to remove or prevent deposit when agitated and thrown about by the active boiling of the water in the boiler, and in some cases it would be preferable to use them alone. But when these loose pieces are used in connection with the wheel, the constant turning of the wheel in the boiler, where such a wheel could be used, would lift up on one side these loose pieces, letting them fall again to the bottom, and thus by constant rubbing or striking against the sides or bottom of the circle, would aid materially in accomplishing the work aimed at in the various arrangements and devices described in this specification. In all these different plans for removing or preventing deposits, it is preferable to use the force which may be obtained from the currents of circulation in the boiler, either of steam or water, or both elements combined, for putting in motion these various devices; but the patentee does not confine himself to this force alone, but reserves the right to attach power from any other source to these or substantially similar apparatus for the purposes herein set forth. Nor does he intend to confine himself to the use of these several arrangements, and their modifications to steam boilers only, but applies the same principles of construction and action to the prevention of deposit in condensers, water pipes, and other apparatus where the same principles can be used for the prevention of deposit, and where it is desirable that deposit should be avoided. In all the above descriptions, reference only has been made to the removal or prevention of deposit on the surfaces of a steam boiler, or other apparatus, in parts or places where such deposit would be objectionable. As these arrangements would not remove the deposits from the boiler, but would of necessity keep them in suspension in the water, or in a powdered or soft state at the bottom, to which point the heaviest particles would usually sink, repeated blowings off only will be required for removing the deposits without the necessity of opening the boiler to clean it.

Fig. 7 shows in section one of the units of the improved boiler hereinbefore referred to, to which an arrangement is applied for removing deposit after it has collected in such thickness as to hinder the proper action of the boiler. In this case, the bolt used for holding the units together at any point where the boiler needs cleaning is taken out, and into the necks of the units there is introduced a wrought iron, or other metal tube, A, as shown in section in this figure. At a short distance from the end of the tube, a slot is cut transversely through it. In this slot is placed a piece of steel or iron, B, about one inch thick, and as wide as the outside diameter of the tube, A. From a centre midway between the ends and edges of this piece of steel, a hole, C, is bored, and from this centre a circle is struck fixing the length of the piece, which is about one inch smaller than the largest inside diameter of the unit, the slot in the tube being made rather longer than the steel plate. Through the hole in the plate, and through corresponding holes in the tube, a steel pin is driven finishing flush at the ends with the outside of the tube. The plate, B, turns freely on the pin to any point required. Inside the tube, which is enlarged at that point for the purpose, small connecting links, D, are placed, which pass on each side of the plate, B, to the point, E, where another hole is bored in the plate, B. Through this hole, and through corresponding holes in the links, another steel pin is inserted connecting the plate and links together, for the purpose hereafter to be described. At the ends of the steel plate, in a mortice or mortices, one or more cutters, F, are placed. The tube described may be made of any length to suit the number of units to be cleaned; and if very long, may be made in sections for greater facility of handling. The operation of the above apparatus is as follows: When the boiler is opened at any part for cleaning, the necks of the units are first cleaned of deposit, so that the tube may pass through them. When the tube is in the unit, by drawing on the links, D, at the point, G, in the direction of the arrow, the plate, B, turns upon its centre, O, causing the steel cutters to come in contact with the deposit on the inside of the unit, at H. If the tube is turned from the end outside, either by hand or other power, the cutters turning slowly on the centre, C, at the same time the spherical portion of the interior of the unit will be cleaned of deposit, with great certainty and facility, however hard the deposit may be. In removing the deposit, as above described, it is preferred to commence at the far end of the row of units, if they are horizontal or nearly so, and as fast as any one unit is cleaned of the deposit on its inside surface, and for the purpose of removing the powdered matter, the cleaning tool is followed up with a pipe nearly the same size as the neck of the unit, this pipe having a flexible end which dips down to the bottom of the unit. By the application of a fan or other means, at the outside end

Fig. 7.



of the pipe, the powdered matter is drawn out. If it should happen that it would be better to cut out the deposit with the units, full or partly filled with water, the powdered matter can be withdrawn with the water by a pump. When the units are vertical, the powdered matter falls out of itself when the lower caps are removed.

MOTIVE POWER ENGINE.

T. E. Merritt, *Rochester.—Patent dated Oct.* 17, 1861.

The improvements specified under these letters patent have reference to the arrangement and construction of apparatus for obtaining motive power, intended to be worked either by the action of steam, gases, compressed air, rarified air, water, vacuum, or atmospheric pressure, whereby, when worked by steam for example, a considerable economy of steam, and consequently of fuel, is effected.

According to this invention, a cylinder and piston are employed, the latter fitting accurately into the former, but in lieu of working them as in ordinary steam engines, the piston is stationary whilst the cylinder itself receives the reciprocating motion due to the steam or other pressure therein. The bore of the cylinder may be only one-half the size of an ordinary cylinder for the same power, but its two ends, upon which the steam operates alternately, are enlarged or expanded so as to obtain the desired area for the steam to exert its pressure upon. For example, a 6-inch cylinder of the improved construction, having its ends expanded to a diameter of 12 inches, will be as effective, other things being the same, as a cylinder of 12 inches bore on the old system. The piston-rod is provided with two steam passages running longitudinally within it, and opening respectively on opposite sides of the stationary piston. The outer ends of these passages communicate with an ordinary slide box and valve, or any other convenient valvular arrangement for governing the inlet and outlet of the steam, or other medium employed to and from the cylinder.

The accompanying engraving represents a vertical section of a portion of a steam engine, showing the improvements. A is the steam cylinder, which, in place of being of a uniform bore throughout, as has heretofore been the case, is expanded considerably at each end, the expanded parts being shown at *a*, *a*. This cylinder may or may not be surrounded by a steam jacket, B. According to this modification the cylinder is made to reciprocate in lieu of the piston, which remains stationary; and, therefore, when not intended for an oscillating engine, the cylinder is guided between two guides, C, suitable guide blocks, D, being cast on the outside of the jacket or cylinder, or otherwise secured thereto E, E, are the end covers of the cylinder; they form also the enlargements, *a*, *a*, before referred to, and are bolted to the main portion of the cylinder at *b*. F is the piston, which is stationary, and which may be made hemispherical on its upper and under sides, as shown, so as to partially fill the steam space at each end of the cylinder, and thereby prevent, to a certain extent, unnecessary waste of steam. The piston is secured to the tubular piston rod, O, which passes through an ordinary stuffing box, H, formed on the lower cover. The lower end of the piston rod, according to this modification, is enlarged at I, so as to form a valve face, in which the ordinary steam and exhaust ports are formed. J is a slide valve actuated by the valve spindle, K, which is worked by eccentrics, or otherwise, and, L, is the steam chest, which is bolted to the valve face, whilst the whole is firmly bolted down by bolts *c*, to the bed plate, M. Two steam ports, *d* and d^1, communicate with passages made through the interior of the piston rod, and communicate at their upper ends by corresponding orifices in the piston at *e* e^1, with the upper and lower portions of the cylinder respectively. The exhaust takes place in the usual manner through the exhaust port, *f*. A pipe, N, secured to, and opening into the jacket of the cylinder, serves to supply the same with steam direct from the boiler, or, if preferred, the exhaust steam may be directed into this jacket. This pipe slides inside the fixed steam pipe N^1, when the cylinder is at work, a suitable stuffing box at O, serving to keep the joint steam tight. Motion is transmitted from the reciprocating cylinder to the main shaft of the engine, either through a connecting rod, P, jointed to the upper cylinder cover, and connected to a crank on the main shaft, or to a beam, as in the ordinary beam engines. By suitably working the slide valve, the steam may be directed alternately into the upper and lower portions of the cylinder, and as the piston is a fixture, it follows that the cylinder will receive the reciprocatory motion hitherto usually imparted to the piston. According to another arrangement, the form of the cylinder, A, remains the same so far as regards the enlarged or expanded ends, *a*, but in lieu of having the steam passages cast inside the piston rod, the patentee makes this rod solid and keys it down to the bed plate. The steam passages are cast in the cylinder, and terminate in the ordinary steam ports made in the valve face, in which, also, is made the ordinary exhaust port. The slide valve is actuated in any convenient manner, and enclosed in the steam chest, which is bolted to the side of the cylinder. In this arrangement it is necessary that the steam pipe should be capable of following the motions of the cylinder, for which purpose it is made to slide steam tight through a stuffing box in a fixed steam pipe. In applying these improvements to an oscillating engine, the cylinder, A, with its expanded ends is attached directly by means of brackets, which are bolted to the cover and to the crank on the main shaft. In this arrangement the piston rod is jointed at its connection with the bed plate, and it is preferred to secure it to a cross-head capable of rocking in bearings bolted down upon the bed plate. The steam and exhaust ports and passages may either be cast in the side of the cylinder itself, as in the arrangement last described, any suitable valve gear being employed for working the valves, or they may be disposed inside the piston rod, as in the illustration, the oscillating motion of that rod being made to effect the desired opening and closing of the ports.

PLANING MACHINES.

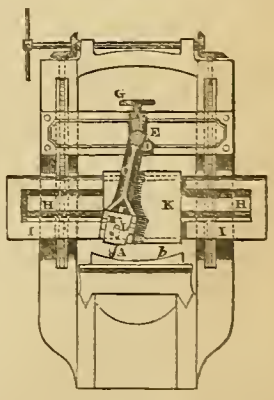
George England, *New Cross, Surrey.—Patent dated October* 22, 1861.

The improvements specified under these letters patent have reference to the arrangement and construction of apparatus for planing curved surfaces in iron or other metals, or hard substances, which arrangement may be easily adapted to ordinary planing machines.

The planing tool is secured to an arm or holder, which is suspended from a stud centre at its upper end, and is consequently capable of being moved or adjusted laterally thereon, so that the tool will describe the arc of a circle, the radius of which depends on the length of the area, whilst facility is at the same time afforded for adjusting the height of the working centre by means of a screw spindle for the purpose of regulating the depth of cut. The length of the arm from the working centre to the point of the tool, corresponds to the radius of the concave curved surface to be cut, which length may be increased or shortened, according to the radius of the curve required; the actual adjustment of the tool for each succeeding cut is effected by a horizontal screw spindle, whilst the height of the cross slide, which carries the working or stud centre of the cutter arm, is regulated by vertical screws in each standard.

The metal to be operated upon may be carried on the ordinary planing machine bed.

The subjoined engraving represents a front elevation of a portion of planing machine, with these improvements attached, for planing concave surfaces, and A is the cutter which is properly secured in its tool-box, B, such box or holder being attached to the lower end of an arm, C, which is free to move laterally upon a stud centre, D, in the fixed cross bar, E. This centre, N, is capable of vertical adjustment for the purpose of regulating the depth of cut by the screw spindle, F, and hand-wheel, G, whilst the lateral adjustment of the arm, C, after each cut is effected by the horizontal screw spindle, H, in the cross slide, I, such spindle working through a nut in the back of the traversing plate, K. A stud or pin, L, shown in dotted lines, on the front of the plate, K, takes into a slot, *a*, made in the arm, C, and consequently as the plate is traversed laterally the arm, C, will move with it, and describe the arc of a circle, the centre of which is at D. The slot, *a*, allows of the free vertical adjustment of the arm and cutter of the screw, F, and enables the pin, L, to work freely therein during the actual adjustment of the plate, K, and arm, C.



It is proposed to have in connection with each machine a set or series of arms, C, of different lengths, so as to plane concave surfaces, *b*, of different radii.

IMPROVED HYDROSTATIC PRESSES.

By Bellhouse and Dorning, *Patentees, Manchester.*

Illustrated by Plates 287 *and* 288.

The eminent engineering firm of E. T. Bellhouse & Co. have long devoted considerable attention to the construction of hydrostatic presses. So much has this been the case, that the name of the firm has become, as it were, inseparably connected with the best and most approved forms of this class of machinery. The hydrostatic press now forms so important an element in compressing fibrous materials and textile fabrics into a bulk suitable for shipment, that it is unnecessary to offer any apology for directing the attention of our readers to this subject.

Figs. 1 and 2, on our plate 287, represent a vertical side and end elevation of an improved Compound Engine and Hydrostatic Press Pumps, arranged in a compact form, for working hydrostatic presses by steam power; and fig. 3, plate 288, is a perspective view of Messrs Bellhouse & Dorning's patent hydrostatic press, which has been specially designed for packing bales of cotton. The general arrangement and construction of this combined engine and press pumps are very simple, strong, and compact, and will be so clearly understood from their delineation in figs. 1 and 2, that very little description is rendered necessary. The principal parts of the engine, which is of the high pressure and diagonal class, the cylinder, guides, feed pump, and the crank end of the main shaft, are all carried by a single vertical side frame or standard placed at right angles to the cistern of the pumps, being secured to it and to the same foundation or bed plate by a strong laterally projecting bracket. The four throw crank shaft for working the four pumps by depending connecting rods is carried in bearings formed on three strong vertical standards erected over and attached to the cistern. This shaft gets its motion direct from the crank shaft of the engine, through a spur wheel on its overhanging end, gearing into a pinion on the inner end of the engine shaft, the bearing at this end being formed in one of the standards carrying the pump shaft. The whole forming a most economical and desirable apparatus for warehouses in which a small number of presses are required to be worked.

In India, cotton-packing presses of enormous power are required, as it is necessary, from considerations connected with the question of freight, to compress the cotton to such a bulk as shall cause one ton weight to equal the measurement allowed for a ton, namely 40 cubic feet.

One of these presses, manufactured by the firm we have named, is upon the compound lever and hydrostatic principle; the construction and mode of operation is as follows:—An iron box is filled with cotton to the depth of 13 feet, pieces of canvas having been laid below and above the cotton. An iron plate, having grooves for ropes on the under surface, is forced downwards a distance of 9 feet 8 inches by means of a worm working in a toothed quadrant, acting upon a knee-jointed set of bars. The peculiarity of this arrangement is that the quadrant and the knee-jointed bars all arrive at the most advantageous position for exerting power at the termination of the stroke, when the cotton is in a smaller bulk and requires great pressure. Doors are now opened just above the point where the descending cover has stopped, and strong iron blocks in a slightly tapered form are pushed in so as to prevent the cover from rising. The table of a powerful hydrostatic press, having rope grooves on the upper side, has so far served as the bottom of the cotton box, and the hydrostatic pressure is now put on and causes the table to rise 2 feet, compressing the cotton into a space of 1 foot 4 inches. Doors are opened at the front and back of the lower part of the box, and ropes are passed through the grooves in the ascending table and descending cover, and the bale is completed, the finished dimensions being 4 feet × 1/4 × 1/4 and the weight 4 cwt. A steam engine works the knee-joint and quadrant motion, and also the power pumps for the hydrostatic cylinder; the diameter of the ram is 18 inches, and the rise 2 feet, and the pumps are made to suit the requirements of speed and power. This press is said to be capable of turning out 80 bales of cotton in ten hours.

We now turn to the hydrostatic press, shown in fig. 3, plate 288, recently patented by Messrs Bellhouse & Dorning. This improved press consists of a novel arrangement of hydrostatic cylinders and rams made to operate in the compression and packing of bales of cotton, wool, yarn, fibre, hair, or other material, but more particularly to the packing of cotton bales, in a suitable form for shipment from India; this, however, is only one of its numerous adaptations.

The patent apparatus consists of a combination of a vertical and a horizontal hydrostatic press. The ram-head or table of each press works vertically and horizontally within a box or casing of its own; the cotton or other material to be compressed being introduced into the boxes or casings, the table or ram-head of the horizontal press is forced by the ram laterally until it is level with the side of the box or casing of the vertical press. The ram-head or table of the vertical press is now caused to rise, and the already partially compressed material is further compressed in a vertical direction until the whole is contained within a small space between the ram-head or table and the top of the vertical press. The upper part of the box or casing is then opened by means of hinged doors and otherwise, so that the bale may be covered with canvas, and corded or hooped in the usual way. A chain and counter-weight, or other suitable contrivance, in communication with the horizontal ram, serves to draw it back, when the water is allowed to escape out of the horizontal cylinder, so as to be in readiness for a fresh supply of material. The ram and table of the vertical press is allowed to descend by its own gravity after the bale is completed, and the making of another bale is proceeded with.

The steam engine and press pumps, shown in the two first figures, have been expressly designed for working this press with the required speed; the whole being easy of management, and securing the continuous operation of the press without loss of time.

This press is compact, and of small height compared with those hitherto used for the manufacture of the Indian cotton bale. The cylinders are of short stroke, so that the cylinders and other castings may be kept of a moderate weight, and be comparatively easy of transport. The several parts of the apparatus are simple, strong, and can be easily got at, in order that repairs, when necessary, may be readily accomplished. The different levels are so arranged that the cotton can be brought to the press, and the packed bale be removed therefrom, by means of inexpensive apparatus.

LAW REPORTS.

Young's Patent Paraffin Oil.—Injunction.—Young *v.* Thornley.—Before Vice-Chancellor Sir W. P. Wood, April 24. In this case the plaintiffs, who are the owners of the patent for obtaining Paraffin and Paraffin Oil by the distillation of bituminous coals, had filed a bill against the defendant, who is an oil merchant at Birmingham, seeking to restrain him from selling under the name of "Young's Patent Paraffin Oil," any oil or similar product which had not been manufactured by the plaintiffs or their licensees, or from selling such oil or similar product, in such manner as to induce the public to believe that the same had been so manufactured. The defendant admitted the fact of the sales, but stated that they had been made by his shopman without his knowledge or consent, and he submitted to the injunction asked for.

Mr Karslake and Mr W. N. Lawson (instructed by Mr J. Henry Johnson) appeared for the plaintiffs. Mr H. F. Bristowe, represented the defendant.

The Vice-Chancellor made an order for a perpetual injunction in the terms of the prayer of the bill, with costs.

Re Mansell's Patent: Petition for Prolongation.—Before the Judicial Committee of the Privy Council, 24th and 25th March, 1862. Present the Lord Justice Knight Bruce, the Lord Justice Turner, and Sir Edward Ryan. This was a petition for the extension of the term of letters patent, dated 1st June, 1848, which had been granted to Mr Richard Christopher Mansell, the petitioner, for his invention of "Certain Improvements in the Construction of Vehicles used on Railways or on Common Roads." Although the petition was presented by Mr Mansell alone, it was admitted that he was not in fact solely interested in the patent, having granted an exclusive license to a company trading as the "Shaft and Axle Company," to work the invention. The invention, as described and claimed in the specification to the letters patent, consists in certain improvements in the adaptation and application of the springs of vehicles, and also in certain novel combinations in the construction of wheels for use on railways or common roads, by which such wheels are rendered safer and more economical in wear than those hitherto used.

In the course of the argument at the bar, on the hearing of the petition, the counsel for the petitioner agreed not to press for a prolongation of that part of the patent which related to springs, and it will, therefore, only be necessary to refer particularly to so much of the invention as consisted of improvements in wheels.

These improvements comprise certain arrangements by which the several parts of the wheel are held together by circular flanged plates or rings of iron, and right and left-handed screws in combination. The construction of the improved wheel is as follows:—The boss or nave is made either of wrought or cast iron, or a combination of both, the inner being of cast iron, through the centre of which the axle passes. The outer iron hoop being tightly shrunk on the inner, prevents the latter from bursting. In this boss the lower ends of the spokes are inserted as right-handed screws, and pass through the outer into the inner hoop of the boss and nave. The spokes are of wrought or cast metal, either solid or hollow—the patentee prefers their being solid, and made of

Plate 287.

COMPOUND ENGINE & HYDROSTATIC PRESS PUMPS,

BY

MESSRS E. T. BELLHOUSE & Co

MANCHESTER.

Fig.1.

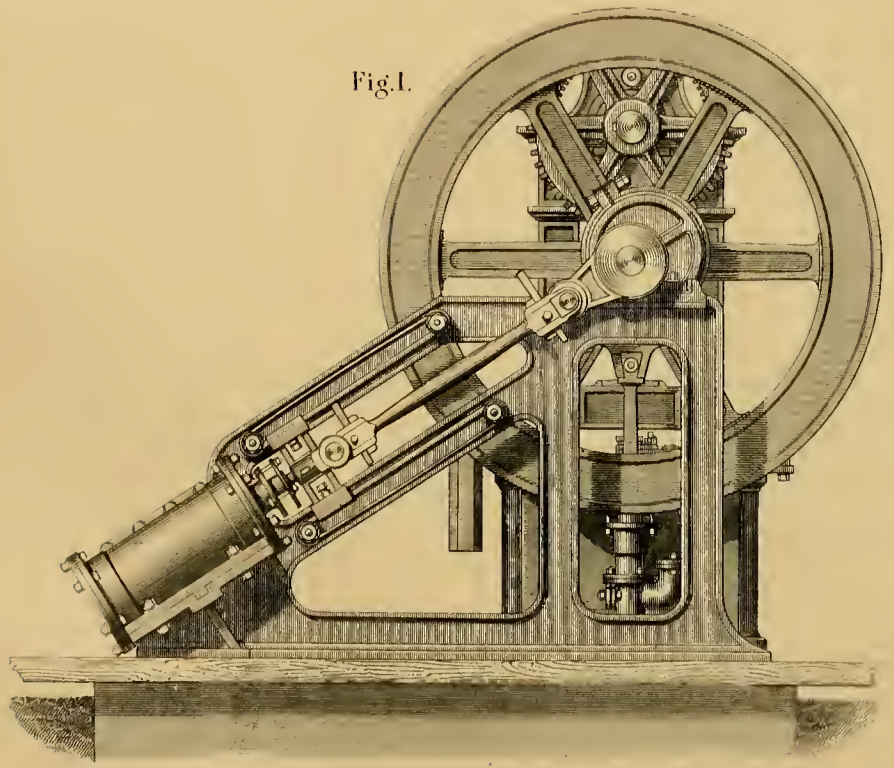
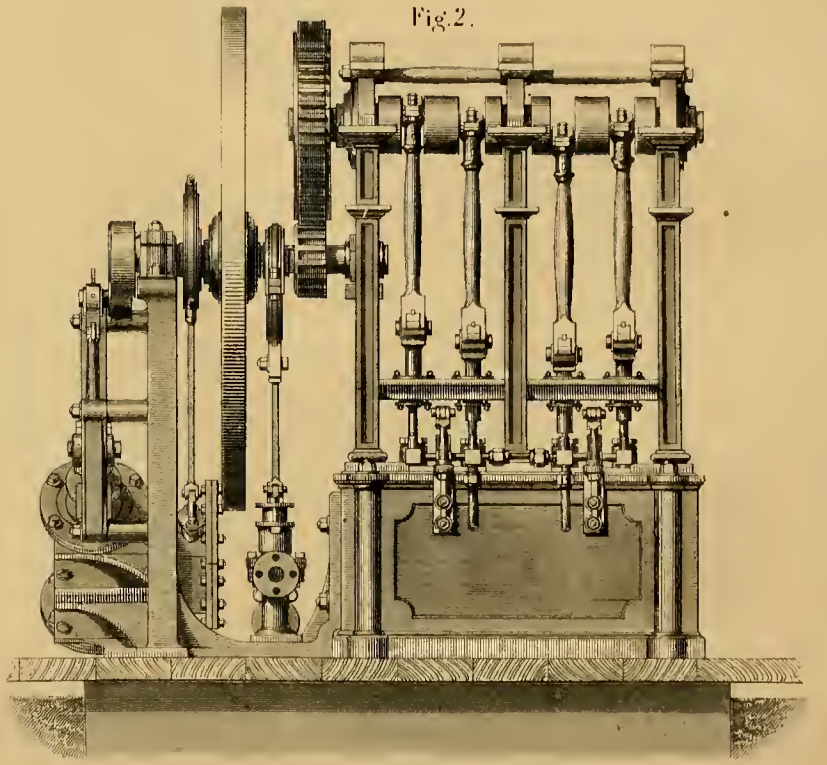


Fig.2.



W. Johnson, Patent Offices, 47, Lincoln's Inn Fields & Glasgow

Mackenzie & Kirkwood

Plate 288.

HYDROSTATIC PRESS,

BY

MESSRS E.T. BELLHOUSE & W.J. DORNING,

PATENTEES, *MANCHESTER.*

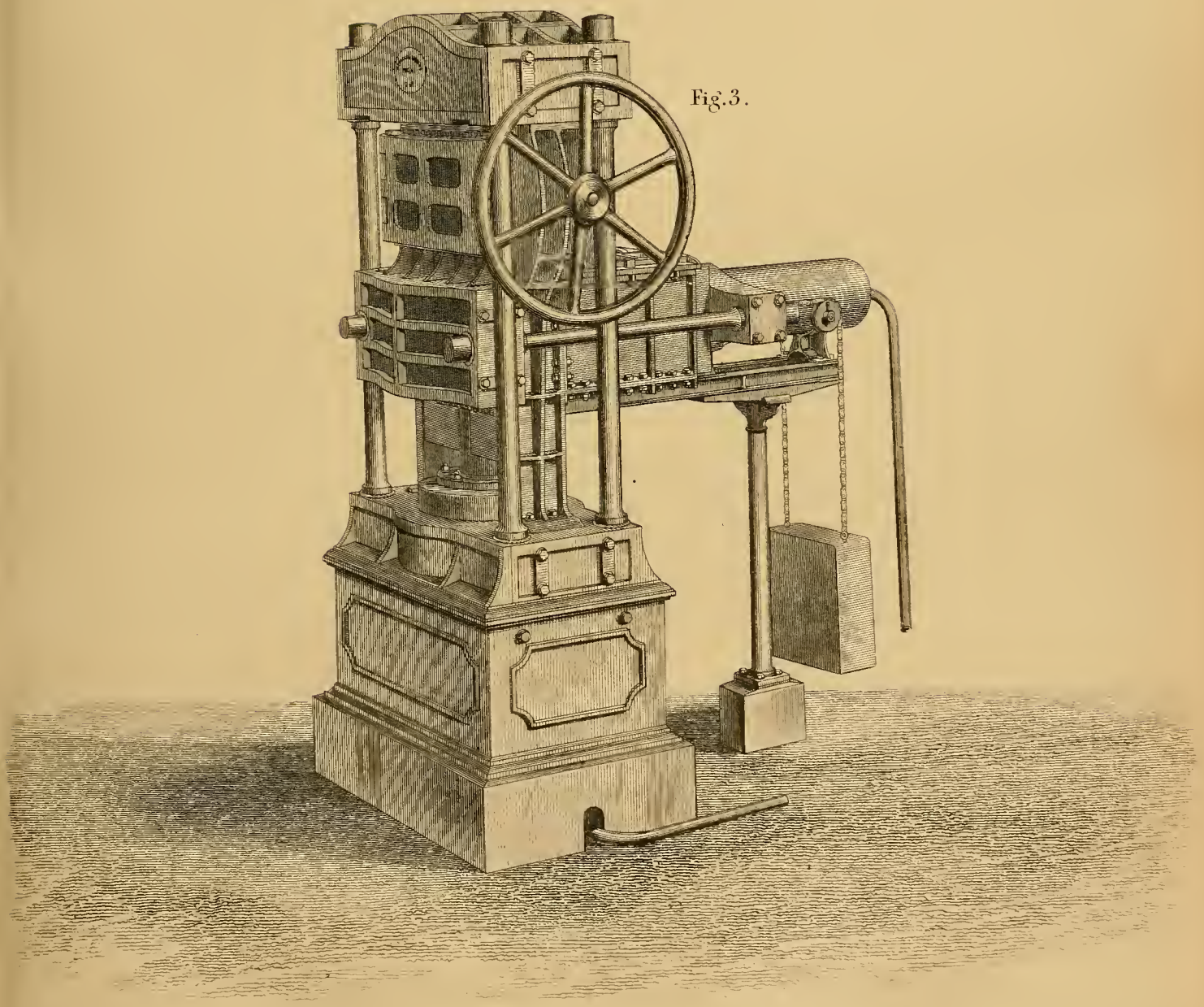


Fig.3.

W. Johnson, Patent Offices,
47, Lincoln's Inn Fields & Glasgow.

wrought iron—round at the ends, the other parts or sides being flat, hexagonal, or octagonal, or any other figure which will enable the spoke to be grasped by a spanner, wrench, or lever. The ends of the spokes which are towards the periphery of the wheel, are constructed with a left-handed screw or thread, and fit into wrought or cast metal shoes, tapped with a spiral aperture to fit the left-handed screw of each spoke. The metal shoes have each two outside flaps, within which the inner periphery of the wheel will rest. This inner periphery is made of oak, or other well seasoned timber, cut to the requisite curve, and sufficiently strong in depth to resist the pressure or blows to which the periphery of wheels is subjected between the bearings of each end of the spokes. The ends of the felloes fit into the outside flaps of the shoes, and take their bearings in each shoe. These flaps have holes in the side, and a bolt is passed through to fix the shoe to the periphery. The bolt also passes through a slot in the spoke, and the whole is riveted together, as is hereafter described. The tyre passes round over the whole. This is a circular bar of cast or wrought iron, with an endless groove formed on each face or side, near to, and parallel with the inner edge of the tyre. These grooves are made to receive the flanges of what the patentee calls the securing or retaining rings. In order, therefore, to put the wheel together, one end of the spokes is placed into the corresponding holes in the boss, the other into the shoes supporting the felloe bearing shoes, till such bearings are at a distance suiting the inner diameter of the wooden periphery, which should be sufficiently contracted to allow the body of the wheel to be easily placed within the tyre. By giving the spokes a screw with a wrench or spanner, the effect will be that the whole is tightened, by pressing the outer periphery of the wood against the inner surface of the tyre. The securing rings are then placed on each side of the wheel, fitting the flanges each into its corresponding groove, and are fixed by bolts or rivets passing through them, the shoes and the wooden periphery, and thus all the parts are fixed together.

The petitioner alleged that a wheel constructed as above described, has the following advantages:—The body of the wheel being a cylindrical disc, and each part being in balance, the wheel is not liable to lose its true figure, and has great durability under constant wear and tear. Moreover, the tyre is less liable to fracture than in ordinary wheels, and is so secured that in the event of its breaking into any number of pieces, no piece can leave the wheel, which will run on in safety. The petitioner put in evidence the reports which were made to the Board of Trade on the accidents which occurred on various railways during the hard frost of January, 1861, in order to show that this last peculiarity in his wheel was of the highest importance, and essential to the safety of railway transit. The petitioner further stated that he had used his utmost endeavours to introduce his wheels into general notice, but that owing to the conflicting interests of persons having other methods of constructing the wheels and fixing the tyres, and to the general distrust of alleged improvements, he had been unable to procure the adoption of his wheels, except partially on the South Eastern Railway, of which he was the carriage superintendent. The petitioner accordingly made the present application on the ground that his remuneration had been inadequate, and he prayed for a grant of new letters patent for a further term of seven years.

The application was opposed by Mr Richard William Johnson, of the Railway Carriage Works, Birmingham, and the grounds of opposition were—1. That the invention did not possess sufficient merit, and was not of sufficient public utility to entitle the petitioner to the prolongation asked for; 2. That the petitioner had been amply remunerated by the profits which he had obtained from his patent; and 3. That if he had failed to obtain a sufficient remuneration, he alone was to blame.

The Solicitor General (Sir Roundell Palmer) and Mr Webster appeared for the petitioner, and Mr Bovill, Q.C., represented the opposer.

After hearing evidence in support of the allegations on both sides, the Lord Justice Knight Bruce delivered the judgment of their Lordships, and said that after having carefully considered the evidence and arguments of counsel, their Lordships were satisfied that the invention had been most meritorious and beneficial, and that the profit which had been hitherto derived from it had not been commensurate with its value: they were, therefore, of opinion that it was their duty to advise Her Majesty to grant an extension of the patent right, so far as it was sought on the present occasion, for a period of two years from the expiration of the present patent. The report which their Lordships would make to Her Majesty would provide for a disclaimer by the patentee of that part of the invention as to which no extension of the patent was asked, and would further provide for the interests of the Shaft and Axle Company.

The registrar suggested that the proper form of report would be to recommend that new letters patent should be granted to Mr Mansell and the Shaft and Axle Company jointly; but their Lordships were of opinion that the better course would be to recommend that the new patent should be granted to Mr Mansell alone, upon an undertaking by him to hold the same for the joint benefit of himself and the company. Their Lordships added that the undertaking must be lodged at the Privy Council Office before the report was made, and that the new patent would be in the former language as to specification, and otherwise, limited only to the particular portion of the invention as to which the extension had been granted.

Photographic Copyright: Mayall *v.* Highley.—Injunction.—This case was originally tried before the Lord Chief Baron, at Guildhall, when a verdict was found for the plaintiff, leave being reserved for the defendant to move. It now came before the Lord Chief Baron, and Barons Martin, Bramwell and Wilde, *in banco*.

The plaintiff and defendant are photographic artists. The former some time past lent to Mr Tallis, late proprietor of the *Illustrated News of the World*, a considerable number of photographic portraits of the celebrities of the day for the purpose of having them engraved and published with that paper. Tallis became bankrupt, and the messenger of the Court sold the photographs to the defendant, who took reduced copies of them and sold them.

Mr M. Smith, Q.C., moved for, in pursuance of leave reserved and obtained, a rule to set aside the verdict and enter it for the defendant, on the ground that the right alleged and the right to the injunction were not proved.

Mr V. Williams, in showing cause against the rule, said,—No question of copyright, either at common law or by statute, arises here. The plaintiff complains that his right of property in the photographs has been interfered with without his consent. That right has been defined to be *jus utendi et fruendi*. The defendant, getting possession of the portraits wrongfully as against the plaintiff, had multiplied copies of them in a reduced form, and afterwards sold them. He had obtained from a Mr Bennett £100 for some, and it was quite clear that the plaintiff's property is depreciated in value in exact proportion to the profit made by the defendant. Those persons who had purchased copies from the defendant were not likely to purchase from the plaintiff. The latter is, therefore, entitled to substantial damages, although he has been content to take a verdict for nominal damages as sufficient, to sustain the injunction granted by Baron Bramwell at chambers. Baron Parke, in "Boosey v. Jeffreys," the great case on copywright, 4, *House of Lords Cases*, said, "The author of a literary composition has an undoubted right at common law to the piece of paper on which his composition is written, and to the copies which he chooses to make of it for himself or for others. If he lends a copy to another his right is not gone; if he lends it to another under an implied undertaking that he is not to part with it, or publish it, he has a right to enforce that undertaking." And Lord Chief Justice Erle in the same case says, "The author has remedies for the wrongful abstraction of copies; he may prevent publication, he may acquire back the copies wrongfully made, he may sue for damages if any are sustained." In these passages (continued Mr V. Williams) pictures may be substituted for literary compositions, as is shown by the case of "Prince Albert v. Strange," 18 L. J., in which Lord Cotteuham applied the same principles to the case where copies of the Queen's and Prince Albert's etchings were surreptitiously obtained, and the publication of them advertised.

Baron Bramwell.—Suppose, Mr Williams, a man discovered some inscriptions upon stones and brought them home, could another take casts of them without his consent and publish them? By so doing the value of the stones would be greatly depreciated.

The Court then called upon

Mr M. Smith, who argued that the plaintiff was not entitled to damages on the first count, or to an injunction, and that the plaintiff had not shown that he had the exclusive right of publishing copies of the portraits. He had lent them to Tallis for the purpose of their being engraved, and after that any one could copy and publish them.

Mr Aspland followed on the same side, contending that the plaintiff was not entitled to an injunction to the extent prayed, as it would prevent the defendant from selling negatives which were his own property, and because the plaintiff had recovered damages in respect of that very matter.

The Court decided that, although the negatives continued the defendant's property, the selling of them would be an act of injury to the plaintiff, and therefore apart from any question of copyright, the sale of them would be actionable; therefore the injunction might issue under the 79th section of the Common Law Procedure Act, 1859. The Court also said that it might have been otherwise if the plaintiff had received full damages in respect of the sale of all the negatives, but the actual damages were nominal only in respect of the right.—Rule discharged, and injunction to go.

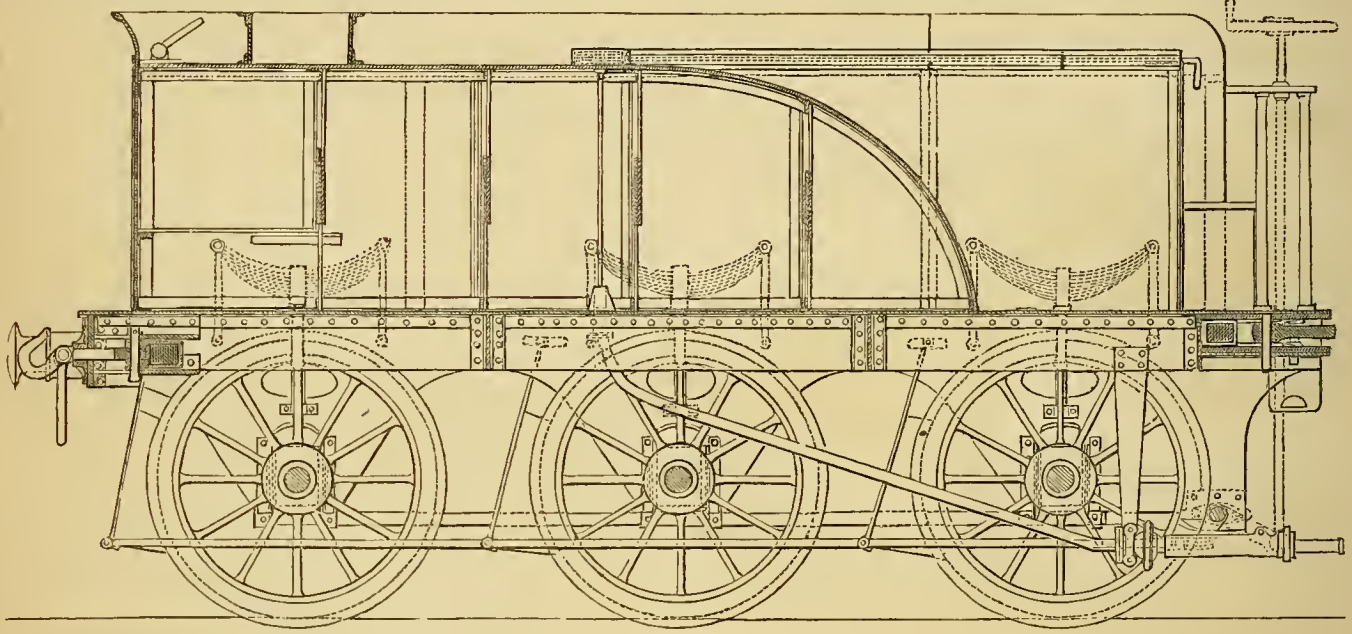
Fenders: Holder *v.* Osborn—Infringement of Registered Design.—This was a case in the Birmingham Police Court, before the stipendiary magistrate of that town. Mr Joseph Holder summoned Mr Mark Osborn, fender manufacturer, "for that he, the said Joseph Holder, was the proprietor of a new and original design for a corner joint for a fender, and that the said Mark Osborn did, without the license of Joseph Holder, sell twelve fenders to which a fraudulent imitation of such

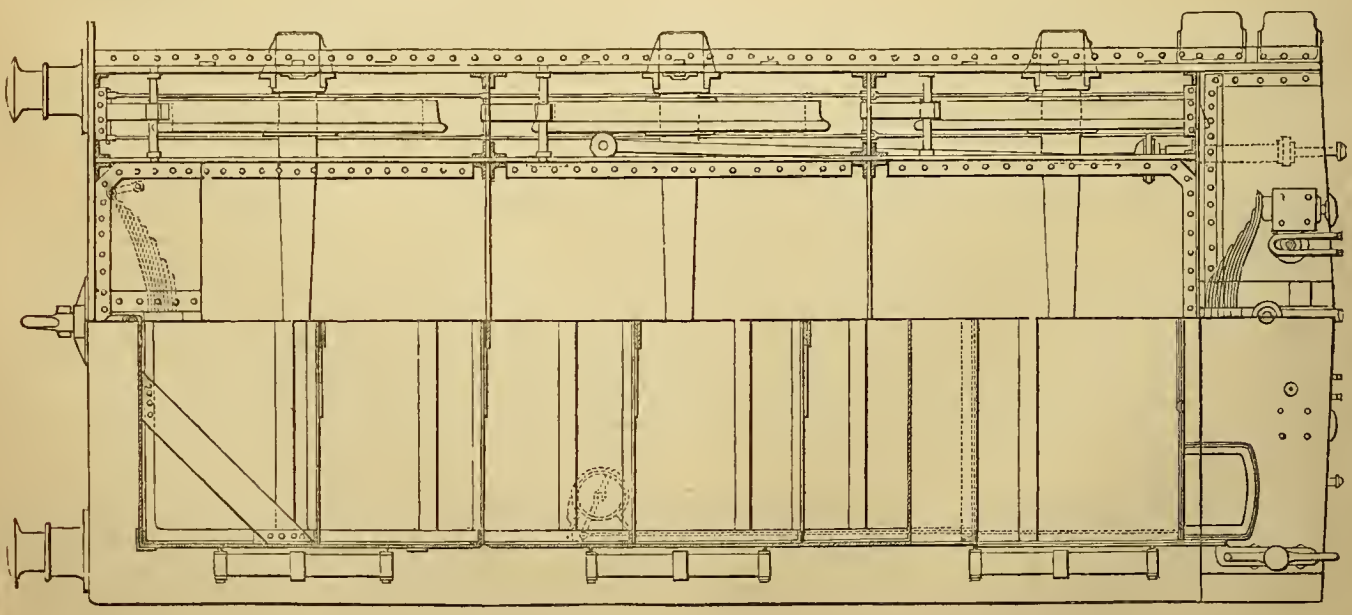
design had been applied. The solicitor for the plaintiff said that he did not think he had sufficient evidence to obtain a conviction against the defendant, and therefore he proposed to withdraw the case. The solicitor for the defendant complained of such a proceeding, as his client was prepared to show that Mr Holder's registered design was altogether illegal, as not being in accordance with the statute. Apart from the statute, the Board of Trade had issued certain directions, one of which was as follows:—"As the Design Acts, 1843 (6 and 7 Vic., c. 65) and 1850 (13 and 14 Vic. c. 104) give protection only to the shape or configuration of articles of utility (and not to any mechanical action, principle, contrivance, application, or adaptation [except in so far as these may be depended upon, and inseparable from the shape or configuration], or to the material of which the article may be composed) no design will be registered, the description of, or statement respecting which, shall contain any working suggestive of the registration being for any such mechanical action, principle, contrivance, application, or principle." The registration of Holder, however, was merely a straight piece of wire, and was not "ornamental and useful." Besides, Mr Osborn had a patent for manufacturing fenders which had entirely superseded the registration of plaintiff. Several specimens of fenders manufactured under plaintiff's registration and defendant's patent were produced, clearly showing the distinction, and then said this was an attempt by plaintiff to get Osborn to grant a license, and was not done for any legitimate purpose; and he therefore asked, under the 13th section of the Registered Designs Act, that the plaintiff be visited with costs. Mr Kynnersley said he thought Mr Osborn was entitled to costs, and he would fix them at three guineas.

TENDER FOR THE EAST INDIAN RAILWAY.

Designed by A. M. Rendel, C.E.

The accompanying engraving represents an elevation plan and transverse section of the tender for the locomotive, shown in Plate 286 of the Journal for last month. The locomotive and tender was designed specially for the East Indian Railway, by Mr A. M. Rendel. At page 35, *ante*, we have given the specification of the tenders as issued by the East Indian Railway Company. The frame of the tender is of wrought iron throughout, with the axle box forks in one piece with the main frame. The hinder end of the tender is fitted with a wrought iron buffer plate, $1\frac{1}{8}$ inches thick, mounted with two





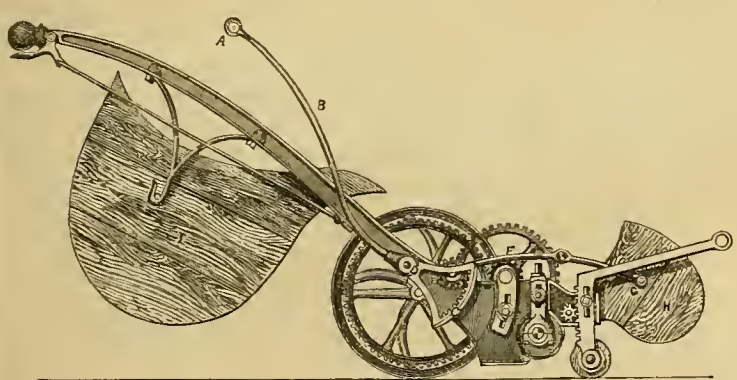
buffers of the kind specified for the engine. A draw spring, 3 feet 6 inches long, is fixed inside the end plate, and provided with links, spring hoop, and drawing apparatus. The wheels are 3 feet 9 inches diameter, and the break is provided with six hangers, one behind each wheel, as shown in the elevation. These hangers are acted upon simultaneously by means of a cross shaft in front, each pair of hangers being connected by cross tie rods. The tank is 6 feet 4 inches wide, by 3 feet 3 inches deep, and curved downwards in front to the bottom, leaving an ample space for coke.

REGISTERED DESIGNS.

LAWN MOWER.

KENNAN & SONS, *Dublin.*

MESSRS KENNAN & SONS, of Dublin, have recently registered some important improvements in lawn mowers, which are illustrated by the accompanying woodcut. The main feature of novelty in these mowers is a simple and effective tipping apparatus for emptying the front or small grass box, H, into the larger receptacle, I, at the rear, as fast as the front box is filled. For this purpose, the box, H, is hung on centres, C, on the ends of two arms, F, which are secured to



a cross shaft carrying two pinions, E. These pinions gear into internal segmental racks, C, formed upon the ends of the levers, B, working on stud centres at D; a handle, A, being fitted to the rear end of these levers for the purpose of working the tipping apparatus. When the box, H, is full, the handle, A, is depressed, and the rack, C, consequently elevated, this motion imparting a rotatory motion to the pinions, E, and their shaft, and causes the arms, F, to rise and carry the box, H, over towards the receptacle, I, reversing its contents into that receptacle. On raising the handle, A, the box returns to its proper position again in front of the cutters.

REVIEWS OF NEW BOOKS.

REPORT ON THE VITAL, SOCIAL, AND ECONOMIC STATISTICS OF GLASGOW FOR 1861. By John Strang, LL.D. 8vo, pp. 92. Glasgow: 1862.

THE indefatigable Chamberlain of the City of Glasgow has again executed his annual labour of love, in telling us what Glasgow has been about during the year just gone by, to what point that great commercial city has reached, and to what end its prospects now point. As the most rapidly progressive industrial city in the kingdom, these annual statements, as to ever-growing Glasgow, are, in the highest degree, interesting, for they present a record of industrial growth unparalleled in history. As a leading fact illustrative of the continued expansion of this working hive, we find that the total population of Glasgow stands at 446,639, against 360,138 in 1851, or an increase within ten years of 86,000, considerably more than the entire population in 1801. Then, again, as to the Clyde, which, fifty years ago, scarcely exceeded five feet in depth, it appears that out of the vessels frequenting the harbour in 1861, there were seventy with a draught of water of eighteen feet, twenty-eight with a draught of nineteen feet, and seven with a draught of twenty feet; and the revenue has run up from £3,400 in 1801 to nearly £106,000 for last year. The pig iron trade exhibits another enormous phase of extension—there being in 1806, 18 smelting furnaces in blast, producing 22,840 tons of iron, whilst in 1861 there were 122 in blast, delivering 1,040,000 tons. The iron steamers built on the busy banks of the Clyde in 1861 were 81 in number, with an aggregate tonnage of 63,245 tons. The extent of the textile trades is shown by the number of spindles at work at the present time spinning cotton, flax, jute, wool, and silk. The aggregate number of spindles for all these classes of materials is 1,048,500 for cotton, 21,152 for flax and jute, 11,748 for wool, and 23,072 for silk. The people employed in the textile factories of Glasgow approach very nearly to 30,000. The recent completion of the great water works for Glasgow is another speaking feature of progress. The daily supply of water from the highland Loch Katrine is 17,000,000 gallons, and this, with 4,000,000 sent in by the Gorbals works on the south side of the Clyde, makes a total of 21,000,000 gallons per day, or actually 46 gallons per head of the population of the city.

These are all striking facts, and well worthy of consideration and comparison with the statistics of rival towns; and we are obliged to Dr Strang for thus affording us the means of so interesting a comparison.

HOW TO DOUBLE THE VALUE OF THE GREAT EXHIBITION TO EXHIBITORS AND THE WORLD By a Non-Exhibitor. Effingham Wilson, London. Pamphlet, 8vo. 1862.

THIS little work—an extremely sensible and seasonable one—is an example of how like lines of independent thought occur in different minds at the same time.

The author's aim and object is to suggest (and point out in some detail) the value of producing a thoroughly complete illustrated record of the Great Exhibition. He proposes to perform on a great scale, and at international expense, what we have in our *Exhibition Record*, actually undertaken upon a smaller scale, and for that part of the whole which excludes fine art proper.

The author commences—"Do we want a record of the Great Exhibition—a means by which every person interested in it, be they in Europe, Asia, Africa, or America, can learn to all intents and purposes, *except to the eye*, as well of what was exhibited, as if on the spot—as well in 1962 or 2062, as in 1862."

The anonymous author devotes his first fourteen or fifteen pages to showing, in a very clear and able manner, how utterly inadequate *The Juries' Reports*, *The Illustrated Catalogue*, and all other works, official and otherwise, are *now* to convey any clear and useful notions as to the objects exhibited in 1851.

He then goes on to show that a work such as he "bodies forth" in all its polyglot completeness—photographing and exactly describing everything—would be, as he believes, (and we agree with him) a richly paying speculation, but that nationally considered, by Europe at large, it would be a good investment if produced at a dead loss of £100,000.

The author, who is a clever, energetic writer, dates from 4 King Street, Cheapside, which may give our London city readers a clue to his individuality.—ED.

THE LAW OF TRADE MARKS, with some account of its History and Development in the decisions of the Courts of Law and Equity. By Edward Lloyd, Esq. of Lincoln's Inn, Barrister at Law. London: William Draper, 1862.

THIS little work, upon a very important branch of law, is a reprint of a series of articles which appeared in the *Solicitors' Journal* during the year 1861 and the early part of 1862.

It contains an able resumé of the whole law of the subject, embracing not merely the decisions of the English courts, but also the doctrines upheld in France and America. This latter part of the work is especially valuable, inasmuch as the law relating to trade marks as administered in the above mentioned foreign countries differs in some important points from the law of this country, and appears to afford greater protection to manufacturers than is accorded by our tribunals. For instance, our own courts have repeatedly laid it down that there is no property in a trade mark, and refuse to interfere to restrain the use of any particular mark by a manufacturer, except when it appears that he is using that mark to pass off his goods as the goods of another man. The English view was thus stated by Lord Langdale.

"The principle in these cases is this, no man has the right to sell his goods as the goods of another. You may express the same principle in a different form, and say that no man has a right to dress himself in colours or adopt and bear symbols to which he has no peculiar or exclusive right, and thereby personate another person for the purpose of inducing the public to suppose either that he is that other person, or that he is connected with and selling the manufacture of such other person, while he is really selling his own. It is perfectly manifest that to do these things is to commit a fraud and a very gross fraud."

And this view has been uniformly acted on in England, except

that in some instances the use of a trade mark has been forbidden, when no fraud has been shown to exist in the person using it, but the effort of the user has been to injure the trade of the person who first adopted it.

The courts of America and France, however, go much further than this, and recognise distinctly the right of property in a trade mark, and thus a manufacturer is in those countries free from the obligation which, as a consequence of the English doctrine, rests upon him here, of showing some positive damage to his property, arising from the piracy of his name or mark before he can obtain relief.

The most important cases on the law under consideration, are examined at length in the volume before us; but there are one or two which are conspicuous by their absence. We allude more especially to the case of Shrimpton *v.* Laight, 18 Beavans Reports, 164, where the present master of the rolls enforced the important doctrine, that in an alleged colourable imitation of a trade mark, the court has not to consider whether manufacturers could distinguish between the articles, but whether the public would be misled by the alleged spurious imitation. The author moreover does not mention the case of Clement *v.* Maddick, 5 Jurist Reports, N.S. 592, in which Vice-Chancellor Stuart carried the jurisdiction to what has been considered, we believe, an extreme length, and granted an injunction at the instance of the proprietor of the newspaper known as "Bell's Life," to restrain the publication of a rival journal under the name of the "Penny Bell's Life." We ought, however, in justice to state that the author gives a report of some cases which are not we believe reported elsewhere. The above mentioned omissions do not however materially detract from the general merit of the work before us, which will be found not merely to form a useful manual for manufacturers and persons engaged in business who may wish to understand their rights on this subject, but also a valuable text book for the guidance of both branches of the legal profession.

We should not omit to mention that the proposals now before Parliament for the amendment of the law of Trade Marks, a notice of which appeared in our last number, p. 46, receive from the author a full and careful examination.

PATENT RIGHTS: AN INQUIRY INTO THEIR NATURE. By A. Percy Simnett. London: James Ridgway.

THIS is a pamphlet in which the general nature of property in ideas is concisely but satisfactorily examined, with a view to test the soundness of the reasoning of those persons who, following the leadership of Sir William Armstrong, are advocating the total abolition of patent rights.

The author combats the notion that ideas are "shadowy nothings floating about in society, and belonging as much to one man as to another," and he argues that the mechanical ideas which have resulted in a machine ought to be considered to stand on the same footing as the literary ideas which form books, and which are on all hands admitted to be subject of property.

The circumstance that in the case of a book no two persons acting without concert would ever produce precisely the same work, while two independent investigators may and often do arrive at identically the same invention, of course suggests a difficulty in dealing with the right of property in one class of ideas which is not felt in dealing with the other, and in the case of simultaneous inventions the important question arises, To whom does the idea belong? The author properly considers that the solution of this difficulty is not to be sought in the plan now so highly recommended, of depriving both inventors of the property and letting the world scramble for it. To do this is a mode of settlement simple enough, but, as the author observes, about as just as would be a proposal in a case of disputed possession of an estate, to burn the title deeds and confiscate the land to the crown. The only way out of the difficulty is that which is now practised and which has the weight of Jeremy Bentham's authority, viz., to give possession to the disputed idea to the inventor who first officially records it.

The author then discusses the alleged objection to the present system, viz., that patent rights interfere with the action of practical men engaged in engineering operations, who, if such rights did not exist, could take up the crude ideas of inventors, and work them out so as to make them really serviceable to the public. Of this objection the most notable apostle is Sir William Armstrong, who, as is well known, stated his case at the meeting of the British Association at Manchester, when he adduced two instances in which he was injuriously affected, the one a case of an improvement devised by him in railway wheels which he could not work because some one else had obtained a patent for it; the other the use of a scheme for welding coils of steel wire for the manufacture of ordnance in which again he was anticipated, when being, as he considered, hampered by the patent rights of another man, he gave up all idea of putting his invention into practice. Upon this the author's remarks are so much to the purpose that we must let him speak for himself.

"Has the patent relating to improvement in railway wheels, of which Sir William Armstrong spoke, been worked by the patentee or any other engineer on his behalf. If it has, we imagine that the public is not much aggrieved. The profits on the sale of such wheels have gone into the pockets of the man who really invented them instead of into those of Sir William, and that is all. If the patent has not been worked, would Sir William, either at the time of which he spoke, or since, have had any difficulty in purchasing the patent wholly or partially? From antecedent probability we think he would not.

"As far as the other case is concerned, the patentee of the steel wire invention, Captain Blackley, happened to be present at the Manchester meeting. He stated that he was not only willing to licence his patent to Sir William Armstrong, but that he had offered to let him work it free of all royalty during the experiments which he contemplated making, and only to claim some compensation, if the invention should ultimately prove useful, and a sale be found for guns constructed on its principle. It would appear from this that Sir William was only hampered by the patent rights of Captain Blackley and the other inventor in the sense that a man would be hampered by the proprietary rights of Lord Palmerston if he wished to build a house on one of that nobleman's estates. No doubt rights of property in land do interfere very much with the proceedings of enterprising builders, but it is not suggested in consequence of this that all freeholds should be abolished."

Sir William Armstrong did not object to rewarding inventors, but proposed to do so by a money grant from Government, instead of a monopoly. The author discusses this question fully, and shows on the authority of Bentham, Mill, and Adam Smith, that a monopoly of the kind objected is really the only method of rewarding inventors which will work in practice.

Mr Simnett does not deny that there are defects in the present law, one of which is undoubtedly the facility with which patents for useless inventions are obtained. These defects arise chiefly, in his opinion, from the patent office being a mere machine for granting patents without any investigation of the titles of inventors to the privilege they seek. He advocates in substitution for the present Commissioners, the connection of most of whom with the office is only nominal, a commission of men qualified to judge of inventions, though not neccessarily engineers. He would empower this commission, in certain cases, of new and strikingly useful inventions, to grant first class patents free of expense; the specification, &c., to be prepared by the office. If, however, the Commissioners considered the invention of slight value, they should notify the same to the applicant, and inform him that all investigations as to novelty must be at his expense. He would then pay a fee for a search, and if the officers should certify that the invention was not new, the applicant might have the question referred to the award of duly appointed arbitrators, and on their decision (which would be subject to appeal on the part of the applicant but not on the part of the commissioners.) We simply state this as the suggestion of a writer who has well considered the subject upon which he treats, but our own opinion, founded on considerable experience of the American system, leads us to believe that the proposal would not be acceptable to inventors.

MECHANIC'S LIBRARY.

Astronomy, Popular and Mathematical, post 8vo, 5s, Cloth. Read.
Hydrology, Manual of, 8vo, 42s, Cloth. Beardmore.
International Exhibition Guide to London, Maps, 4s 6d, Cloth.
Scientific and other Subjects, Essays on, 8vo, 14s, Cloth. Holland.
Stained Glass Windows, Catalogue of, 4to, 2s 6d. Heaton and Buller.
Steam and the Marine Engine, Study of, post 8vo, 5s 6d, Cloth. Saxley.

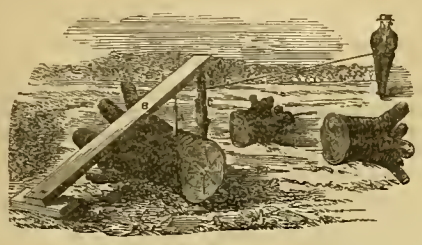
CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

BLASTING TREE STUMPS BY PERCUSSION CARTRIDGES.

My percussion cartridges for blasting and splitting the stumps of trees and other large timber, is now being generally used in Ireland, in procuring fuel for the poor. The engraving fully illustrates the mode which I have adopted. An inch hole is bored somewhat more than half way through the most unwedgable part of the stump, the cartridge is then inserted, and rammed to the bottom of the hole by means of the cylindrical iron bar, A; my "phlogistic pill" is now dropped into the hole, upon the cartridge, and the iron bar is re-inserted in the bore, its lower end being left within three or four inches of the pill; the bar is supported in this position in any simple manner, such as a thin wire passed through

a transverse hole and resting on the stump. A heavy plank of wood, B, having a short transverse plank on its outer lower end to keep it steady, is then raised in an inclined position over the stump, and it is supported in this position by a timber pillar, C, so that it overtops the head of the bar, A, by three or four feet. A cord is attached to the upper part of the pillar, and when all is ready, the plank support, C, is pulled away by this cord, and the plank, B, falling on the bar explodes the cartridge and shivers the stump. The lower end of the iron bar may have a recess formed in its lower end to hold the pill, so that the latter may be withdrawn, if it should not be expedient to fire the charge after it is put in. The explosive power of the cartridge is greater under this system of firing, than when it is fired with a fuse by tamping, because the fuse acts slower in igniting the whole of the gunpowder. I am satisfied that this mode of procuring fuel would be most useful in England and Scotland, and I shall be glad to hear that it has been tried there.



Kingston, Dublin. J Norton.

A NEW STEAM GENERATOR.

Sir,—The recent very awful boiler explosion at Priestfield, near Wolverhampton, at the ironworks, and where no less than 26 lives have been sacrificed, constrains me to take a course I otherwise would not have done so soon—namely, to publish a means of generating steam of a considerably greater elastic force than that produced in the ordinary boilers, even at the highest possible pressure that can be arrived at by building these boilers ever so strong. Now, a pressure of even as much as 500lb. per square inch may be raised in this apparatus that I am desirous of introducing to your notice, and while at that pressure, if an explosion were to occur, not the slightest danger to life need be apprehended by any one standing beside or sitting upon it, as there is no boiler. I can naturally suppose you will say this is a startling assertion, that steam can be raised without a boiler. Therefore, if you allow me, I will endeavour to explain the matter to you. I have an apparatus of between 3 and 4-horse power now at work, giving every possible satisfaction, and I may add, without at all being an egotist, that the results we have had from it are truly wonderful for quick generation, great power, large saving of fuel, and perfect control, being entirely free from danger; and the space it occupies is only equal to about four cubic feet. Now, although I am only using this for about 3-horse power, its capacity is quite sufficient for 10-horse.

But, to describe the principle,—as steam is required to be generated, I cause a very small quantity of cold water to be injected into a metal pipe of small bore, and which passes in a serpentine figure through the furnace, and above the intense heat of the ignited fuel. This furnace is for the purpose of heating the generator, which is a cylindrical chamber, containing about 3,000 cubic inches of space, the small serpentine feed-pipe always being quite hot, or sufficiently so that so soon as the water, which is not more than a quarter of a cubic inch at each successive stroke, is squirted into it by means of a small force-pump, it immediately flashes into steam, when, after rapidly travelling through this pipe, of course surcharging all the time, it passes through an induction valve into another serpentine pipe of the same dimensions as the first; this is laid in, and on the bottom of, the generator. Now this pipe eventually terminates in a large rose-head (like the top of a garden watering-pot), that distributes the steam into the generating chamber for the purpose of surcharging it to any extent of expansion, consequent upon the amount of heat applied. The generating chamber is so formed and fixed that the whole surface is entirely exposed to the heat of the fire, and to the heated products of combustion passing therefrom; and the generator never at any time contains any water, or anything in a liquid state, for directly the water (being such a small quantity) is forced into the hot serpentine feed-pipe conversion takes place. It is therefore an instantaneous generation and surcharging of steam, as long as the necessary heat is kept up, and which is a saving in fuel of 60 or 70 per cent. in comparison with the ordinary boiler's consumption.

Now I think you may easily perceive by the above description that unless water is pumped in no power can be gained. For example, say I have not a particle of steam in the generating chamber; the heat of course being applied (by the fire having been previously lighted), I will now force in one cubic inch of water by the means and through the channel I have previously shown, when it immediately—yes, in one second, it expands (by passing over such an immense amount of heating surface) into the enormous quantity of 50,000 times its original liquid volume, and upon this one inch of water the engines are put in motion and the self-acting feed commences; and, although the steam is quite invisible when escaping from the safety valve, still it is (unlike the hitherto superheated steam) beautifully humid and cool, the engines that are worked by it requiring no lubrication beyond a small drop of oil to the cylinders, and the common hemp and tallow is all that is necessary to be used as a packing for piston and slide glands.

By my foregoing statement I think it will be clear to our scientific engineers that no danger can result from an explosion, as there is no volume of water from which power is procured. Consequently, if it actually should explode by undue pressure, so soon as vent is given it will be all gone, being so very fine. In fact, I have had a practical illustration of this at 48lb. pressure to the square inch, and I did not experience the slightest inconvenience, even when I was holding down the lever of the safety valve at the time; but, of course, the power was soon gone, through a rent made of more than five inches long, and, if I may be allowed the comparison, it had no greater effect than blowing a large paper bag full of atmospheric air, and then by a sharp blow bursting it. Nothing was to be seen. Really I could not imagine that the generator, of cast iron, three-quarters of an inch thick, containing more than a cubic foot of space, at a pressure of 48lb. to the inch, had gone, until after a careful examination, upon finding my engine stop, consequent upon the power getting away faster than generation, and with a tremendous roaring noise—for that was the only indication I had, as I could see nothing.

And now, Sir, I will not attempt to intrude longer upon you, but give a free invitation to all our leading practical engineers to favour me with a visit as early as possible (begging I may be previously notified of their coming) to the Royal Small-arms Factory, Enfield, when I shall be most happy to render every information by explaining with drawings, &c., and exhibiting the apparatus at work. This achievement is the result of 18 months' hard labour; and, as boiler explosions do not appear on the decline, but on the contrary, and attended with more awful consequences, it is now quite time something should be done to remedy the evil. I have therefore presumed to submit this to you, with an earnest desire that our engineers should read it in your columns, and am, Sir, yours truly and obliged,

Chas. F. Hayes, Engineer,
Superintendent, Lock and Screw Departments.

Royal Small-arms Factory, May, 1862.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

March 20, 1862.—"Suggestions for the Attainment of a Systematic Representation of the Physical Aspect of the Moon," by Prof. J. Phillips.—Dr Frankland, on the part of Prof. Tyndall, exhibited some of M. Plateau's experiments on thin films, bringing out their iridescence with the electric light.

March 27, 1862.—"Theoretical Considerations on the conditions under which the Drift Deposits containing the Remains of Extinct Mammalia and Flint Implements were accumulated, and on their Geological Age." by Mr J. Prestwich.

ROYAL INSTITUTION.

Jan. 24, 1862.—"On the Affinities and Differences between the Brain of Man and the Brains of certain Animals," by Dr Bollcston.

Feb. 7, 1862.—"On Fossil Remains of Man," by Prof. Huxley.

March 7, 1862.—"On the Distribution of Northern Plants," by Prof. D. Oliver.—"On Motion in Plants and Animals," by Mr W. S. Savory.

March 21, 1862.—"On some of the Causes, Effects, and Military Applications of Explosions," by Mr F. A. Abel.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

March 18, 1862.—"On the Probable Cause of Electrical Storms," by Mr J. P. Joule.—"On the Employment of Galvanised Iron for Armour-Plated Ships," by Dr Calvert.

The author stated that he had been for some time past engaged in ascertaining the chemical composition of various woods employed and susceptible of being employed in the navy. On a recent visit to one of the dockyards he found that while the armour plates were fixed against the layer of teak, the ribs of the ship were of oak, and that the iron bolts which were to fasten the plates were to pass through the oak ribs. It occurred to him that the inconvenience which would probably result from the action of the oak upon the iron might be obviated by substituting galvanized iron bolts for those now in use, and he therefore instituted a series of experiments, the results of which were as follows:—

The first series of experiments consisted in having driven through large

pieces of oak, bolts and screws of iron and galvanized iron prepared by Messrs Johnson, of Manchester, which were then immersed in soft and sea water for the last three months. The results clearly showed, first, that the friction did not remove the zinc from the galvanized iron; secondly, that the oak and galvanized bolts were unchanged; whilst in the case of the iron bolts, they were much rusted, and the pieces of oak had become quite black by the formation of tannate and gallate of peroxide of iron. During the experiments the waters were changed every week, and those containing the galvanized iron appeared unchanged, whilst in the case of the iron, they had a dark blue-black appearance, owing to the formation of gallate and tannate of iron.

In order to ascertain the comparative action of soft and salt water upon iron and galvanized iron when in contact with oak under identical circumstances, he made the following series of experiments.

Plates of galvanized iron having 18 inches of surface lost during three months the following weights:—

	SOFT WATER.	SEA WATER.
Plate No. 1	0.10 grains.	———
,, No. 2	0.11 ,,	———
,, No. 3		0.095 grains.
,, No. 4		0.090 ,,

Similar plates of iron lost during the same time:—

	SOFT WATER.	SEA WATER.
Plate No. 1	1.23 grains.	———
,, No. 2	1.52 ,,	———
,, No. 3		2.40 grains.
,, No. 4		2.38 ,,

There can therefore be no doubt that galvanized iron offers great advantages, the action of water on it being less than a tenth of the same action on ordinary iron. As there is no doubt that iron when galvanized is in the most favourable electrical condition to resist the action of oxygen, being in an electro-negative condition, it follows that in all probability the use of galvanized iron would be very advantageous in armour-plated and other iron ships. The author hoped that Government and other large ship builders would avail themselves of this suggestion, and make experiments on a large scale to verify the results he had obtained.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the ordinary Monthly Meeting of the Executive Committee of this Association, Mr L. E. Fletcher, chief engineer, presented his Monthly Report, of which the following is an abstract:—

"During the last month there have been examined 383 engines, 2 specially; 514 boilers, 10 specially, 8 internally, 51 thoroughly, and 445 externally, in which the following defects have been found:—Fracture, 11 (4 dangerous); corrosion, 28 (1 dangerous); safety valves out of order, 8; water gauges ditto, 15; pressure gauges ditto, 13; feed apparatuses ditto, 2; blow off cocks ditto, 56 (2 dangerous); fusible plugs ditto, 2; furnaces out of shape, 14 (5 dangerous). Total, 149 (12 dangerous). Boilers without glass water gauges, 17; without pressure gauges, 7; without blow-off cocks, 53; without back pressure valves, 87; while a single boiler was found without any independent safety-valve, having only the limited use of one in partnership with another boiler, the connection to which depended on the junction valve being open.

"An explosion of a most fatal character, resulting in the loss of no less than six lives, has happened during the past month; while another, which took place in the preceding one, in addition to the five referred to in the last Monthly Report, occurred to a locomotive boiler, in consequence of the plates being internally corroded to $\frac{1}{4}$th of an inch in thickness. Not one of these boilers, however, was under the inspection of this Association.

"In the first of the above cases the boiler was a vertical one, and had been at work for eight years. It was set so as to utilise the waste heat of one or more iron furnaces, the flames from which first surrounded its lower half, and then passed into a central internal-descending flue through openings in its side. Its outer shell was egg-ended in shape, the height being 21 feet 3 inches, the diameter 9 feet, and the thickness of the plates $\frac{7}{16}$ths. In the internal-descending flue the diameter was 4 feet 8 inches, and the thickness of the plates $\frac{5}{8}$ths all over. The crown, which was attached to the flue by means of an angle-iron only $\frac{5}{8}$ths of an inch thick, was formed by two plates, a seam of rivets running across the centre, and was stated to have been cambered about 4 inches, upon which—since it was not strengthened by any stays whatever—it entirely depended for stiffness and power to resist the downward strain leading to collapse. The boiler had been fitted with two safety-valves, loaded to about 50 lbs. on the square inch, one of them a dead-weight valve, and both of very ample area, the diameter of each being 6 inches; also, there had been a self-acting alarm float, with other necessary gauges and feed apparatus.

"I examined the boiler the day after the explosion had happened, and found that it had flown upwards through the roof of the building, when, being caught with a strong north-east wind blowing at the time, it had been carried a considerable distance, and landed on an adjoining mound of earth. It is probable that, had there been less wind, it would have fallen on the building, and thereby not only have crushed in the roof and machinery in its fall, but added considerably to the loss of life. As the explosion occurred just at daybreak, no reliable observations were made of its flight; but, from the chimneys it cleared in its course, it must evidently have soared to a considerable height.

"It is remarkable that five out of eight weights of flat disc, or cheese shape, with which the direct acting safety-valve had been loaded, retained their position on the boiler throughout its flight, although they had no other attachment to it than the stability afforded by the safety-valve as a base upon which they were piled. Judging from the position in which they lay, they appear only to have broken away on the shock of the boiler coming to the ground.

"The cause of the explosion was apparent at a glance. The entire crown of the vertical-descending flue had been blown out, the angle-iron by which the crown was attached to the sides of the flue being rent at the root completely round the whole circle. The two circular seams of rivets in this angle iron were both undisturbed; one retaining a part of it on the cylindrical sides of the flue, while the other held the remainder to the crown-plate, with which it was carried away entire.

"Evidence was adduced at the inquest to prove that the failure of this angle iron resulted from overheating of the plates, consequent on shortness of water; the line of argument adopted being that no pressure the boiler could have sustained would have been sufficient to have shorn the angle-iron unless red hot, and experiments were instituted which were stated to prove that nothing less than a pressure of 1,260 lbs. on the square inch could have rent the boiler as it had been unless the plates had been heated from shortness of water. The Jury brought in a verdict of manslaughter against the attendant, on the ground of negligence, and he was consequently committed for trial at the approaching Assizes.

"I beg to differ most decidedly from the above evidence, and to take the following view of the failure of the angle-iron, which will be readily understood by those of our members who have watched the tendency of the front plate in their double-flued boilers to groove. The total pressure on the crown plate was about 50 tons; the whole of which had to be borne by this $\frac{5}{8}$th angle-iron, which was much too light for the duty. This load would vary with every alteration in the pressure of the steam, and be entirely removed when the boiler was at rest, and re-imposed when the steam was again got up. These constant variations of load would produce an alternating movement in the angle-iron, which would fret and rapidly deteriorate it, rendering fracture ultimately inevitable, and its occurrence merely a matter of time. It is to this cause, continued incessantly through eight years—the life of the boiler—that I attribute the failure of the angle-iron, and consequently the explosion, and not to shortness of water.

"I cannot doubt that an application of the hydraulic test would have detected this weakness in the angle-iron in time to have prevented the explosion, the occurrence of which affords an illustration of the hazard of trusting so much to a single angle-iron; and the fact of 99 having proved trustworthy is no guarantee that the hundredth may not fail, as in the present instance. It is always bad engineering to trust so much to a single thread, especially where loss of life may occur from its failure.

"It will be remembered that in the last Monthly Report it was stated that three boilers, working side by side, had been reported to have exploded simultaneously, the occurrence being attended with loss of life to the engineman. I have since then visited the scene of the explosion, and found the report a true one, while the injury caused to the surrounding property was beyond any I had before witnessed.

"These boilers had been of plain cylindrical egg-ended construction, fired underneath, and about 30 feet long, which, in addition to a Cornish one, with a single flue, had originally worked side by side, being all connected together. The latter being out of work at the time, escaped, or, from the injuries it received from the explosion of the others, would certainly have shared their fate. The egg-ended boilers had rent in the main, at the transverse seams, and the portions had flown more than a quarter of a mile apart. One of these had alighted on a cottage, which it had seriously damaged; another into a reservoir; the egg-ends flying to the greatest distance, and smaller fragments falling nearer their original seat. The chimney, as well as a blast furnace, were brought down and reduced to a heap of ruins by one of the egg-ends in its flight; while a second furnace had the feeding gallery at its top dismantled. The roof of the adjoining engine house was completely stripped of its covering, and the woodwork shifted bodily, breaking one of the engine beams by its movement. The original seatings of the boilers were reduced to an unintelligible heap, while bricks, and the *débris* generally, were scattered like grape-shot over the surrounding land in every direction. The Cornish boiler had been blown from its seat, and so strained by its fall that it had rent at the bottom of one of its transverse seams, as well as at the front plate at the junction of the furnace tube.

"The cause of the explosion was again attributed, as in the preceding instance, to shortness of water, consequent on the negligence of the attendant, who, it was supposed, had first allowed the plates to become overheated, and then suddenly admitted a rush of cold water. I carefully examined the parts, with a view of ascertaining how far this supposition was correct, but could not come to the conclusion that it was proved to be so. The supply of the feed to the boilers was found, on examination shortly after the explosion, to be cut off, which contradicted the supposition that a rush of cold water was let in immediately before its occurrence. Again, the engine had been at work for about a quarter of an hour, and had the explosion been caused by a sudden pressure of steam, generated by the dash of water upon heated plates, it would have taken place immediately on the starting of the engine. On consideration of the whole of the circumstances, which space forbids recounting in detail, I think it most probable that, in the first instance, one of the boilers rent over the fire, at a transverse seam, the treachery of which in these under-fired boilers is so common, and to instances of which the attention of the members has been called in the Reports. Plain cylindrical boilers rending in this way always fly a great distance, as these had done, having time, while in the act of completing the rent from the bottom to the top of the transverse seam, to take a sufficient angle of elevation both for the clearance of obstacles and the attainment of long range. The

escape of water and steam from this opening at the bottom of the boiler would destroy the brick seating and blow up the sister ones, which, falling again on an irregular bed of loose brick, would become so strained as to rend, just as the empty Cornish boiler already described had done, and which in boilers having their steam up would be inevitably followed by explosion.

"I consider the above a further illustration of the inferiority of external to internal firing, and would point out that every one of the five explosions reported during the last month happened not to internally but to externally fired boilers, and am increasingly impressed with the fact that this district has done wisely in selecting the Cornish type of boiler in preference to the plain cylindrical egg-ended one, and that, not only on the ground of efficiency and economy, upon which there can be no question, but also as regards safety."

CHEMICAL SOCIETY.

March 6, 1862.—"On Specific Heat in Relation to Chemical Combination," by Mr James Croll.—"On the Indifferent Hydrocarbons found in Boghead Tar," by Mr Greville Williams. Since publishing his previous results, he had succeeded in isolating the hydride of amyl. The compounds which he had formerly regarded as radicles, he now looked upon as homologues of Marsh gas.

GEOLOGISTS' ASSOCIATION.

May 5.—Professor Tennant, F.R.S., President in the chair. The following papers were read:—

1st.—"On Bone Beds, their position in sedimentary strata and probable origin," by G. E. Roberts, Esq.

2nd.—"On a Superficial Freshwater Deposit near Blackfriars Road," by C. Evans, Esq.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

March 27, 1862.—"On Retaining Walls," by Walter Rutt.

GLASGOW ARCHITECTURAL SOCIETY.

April 21, 1862.—"On Modern Architecture," by Mr J. J. Stevenson.

INSTITUTION OF ENGINEERS IN IRELAND.

April 9, 1862.—"On a 50-ton Crane recently erected at Belfast," by Mr G. H. Strype.

GEOLOGICAL SOCIETY OF DUBLIN.

Anniversary, 14th Feb., 1862.

President's Address—(*Continued from page* 53.)

No. 1. *Mont Blanc.* North side, 15,200 feet high.
Analysed by Schönfeld and Roscoe.—Ann. Ch. Phar. 91, 305: 1854. Sp. gr. = 2·7088.

No. 2. *Mont Blanc.* Highest peak.
Analysed by Delesse.—Bull. Soc. Geol. (2.), 6, 246: 1849.
Sp. gr. = 2·72. Rich in grey Quartz; greyish-white Orthoclase; Oligoclase, greenish from the intermixed Talc; Mica, dark-green.

No. 3. *Mont Blanc.* Extremity of Mer de Glace.
Analysed by Delesse.—*Loc. cit.*
Sp. gr. undetermined. Quartz, feeble reddish grey; Orthoclase and Oligoclase, white; Talc, clear green; Mica, dark-green; Ripidolite, sparingly mixed.

No. 4. *Mont Blanc.* Aiguille du'Drn.
Analysed by Delesse and Ringuelet.—*Loc. cit.*
Sp. gr. undetermined. Quartz; white Orthoclase; Oligoclase; Talc, coloured.

No. 5. *Valorsine Thal*, on the road near Rupes.
Analysed by Delesse.—Bull. Soc. Geol. (2.), 7, 426: 1850.
Sp. gr. undetermined. Quartz; Orthoclase, greyish-white; Oligoclase, greenish-white; Mica, pinchbeck, and white.

No. 6. *Mont Blanc.* 500 feet below summit, on north side.
Analysed by Haughton.—Journ. Geol. Soc. Dub., vol. ix., p. 219.
Sp. gr. = 2·671. Medium-grained Granite, of slaty structure; Quartz, large and visible, ($\frac{2}{10}$th in.), grey; translucent white Orthoclase, in crystals ($\frac{1}{4}$ — $\frac{1}{8}$ in.); Oligoclase, pale-green, crystals, size of last; Mica, blackish-green, in spots.

Of the preceding analyses. Nos. 2, 3, 4. and 5, by Delesse, are worthless in the present inquiry, as they contain no estimate of the magnesia, and they are also, in other respects, very deficient; the quantity of magnesia found in Nos. 1 and 6 is not sensibly greater than that always found in granites that never were supposed to contain Talc—a mineral that includes 33 per cent. of magnesia in its composition, but which do contain a dark-coloured Iron and Magnesia Mica. In fact, the granite of Mont Blanc is identical with that of the Leinster range, as is shown by the following comparison:—

	Mont Blanc. Mean of 6 Analyses.	Leinster Range* Mean of 11 Analyses.
Silica,	72·80	72·07
Alumina,	13·23	14·81
Iron (peroxide),	1·98	2·22
Iron (protoxide),	1·48	0·30
Manganese (protoxide),	0·40	
Lime,	1·34	1·63
Magnesia,	0 62	0·33
Potash,	3·62	5·11
Soda,	3·69	2·79
Water,	0·76	1·09
	99·92	100·05

I have dwelt on this subject at greater length, perhaps, than its importance deserves; but I was anxious to establish the serious danger of neglecting the geological canon—"Not to assume in a rock the existence of a mineral, unless its presence is established by distinct analysis."

The neglect of this canon has led, as we have seen, to the invention of Protogene, which has no existence except in the imagination of its authors; and yet the definition of this phantom-rock appears from year to year in the most approved text-books of English geologists.

It must not, however, be forgotten, that in the opinion of M. Brochant de Villiers,† one of the highest authorities on this question, no true granite is to be found in the chain of the high Alps, which, according to him, are composed altogether of talcose schists, talcose limestone, serpentines, and talcose felspathic schists; while the true granites of the Alps are to be sought in the low ground to the south of the Alps, at Biella, Crevacore, La Sesia, Baveno, and other places. The conclusions of M. Brochant de Villiers' remarkable Memoir are summed up as follows:—

"1st. That the granitic rocks of Mont Blanc, and others resembling them of the high summits of the Alps (from the Mont Cenis to St. Gothard), are not granites, and that consequently there does not appear to be any true granite in these high crests.

"2nd. That these granitic rocks are but extreme varieties (more crystalline and more abounding in felspar), of a talcose felspathic rock, much more abundant in the Alps, and with which it is found united.

"3rd. That this talcose rock, also associated with other talcose rocks, constitutes a peculiar formation, predominant in a great part of the Alps.

"4th. That ores of metals almost always occur as beds in this formation.

"5th. That a true granitic formation exists in the Alps on the southern edge of the chain, which, from analogies founded on all the facts now received in geology, contributes, with all the preceding characters, to establish the little relative antiquity of the supposed granites of Mont Blanc and the high Alps, as well as that of the talcose rocks, of which it forms a part."

While I readily admit that talc is to be found in abundance in the metamorphic rocks of the Alps, I believe M. Brochant to be in error, when he denies the existence of true granite, in a narrow band, running along the summits of the high Alps.

The following analysis of a specimen of talc, from the granitoid schists of the neighbourhood of the Handeck Falls, in the Grimsel Pass—given to me by Mr S. Robert Reeves—shows the character of the Swiss talc, and, at the same time, demonstrates its non-existence as a constituent of the so-called Protogene of Mont Blanc.

TALC FROM NEAR HANDECK.

	Per-centage.	Oxygen.	Atoms.
Silica,	61·26	31·77	5
Alumina,	0·60		
Iron (peroxide),	2·38		
Lime,	0·23	0·06	
Magnesia,	30·80	12·31	
Soda,	0·06	0·01	12·59 2
Potash,	0·11	0·01	
Iron (protoxide),	0·92	0·20	
Water,	1·20	1·07	
	97·50		

The truth appears to be, that geologists who have sought for the eruptive

* Trans. Royal Irish Academy, Vol. xxiii., p. 599 (Science).
† Annales des Mines, 1819.

characters of granite in the Alps have been surprised to find what appeared to them only a highly inclined metamorphic felspathic schist, flanked by micaceous talcose and calcareous rocks, to which the eruptive character could not with propriety be attributed. This difficulty, however, disappears as soon as we abandon our preconceived notion of how granite ought to present itself. In Donegal, for example, we find true granite, which, in its structure and bedding, is indentical with the heds of limestone, felspathic schist, and mica slate, with which it is *interstratified*, flanked, as in the Alps with steatitic beds of taleose slate, and having mineral lodes occupying the planes of its lamiuated structure.

In Sweden and Norway, also, the granite heds pass by insensihle gradations into the adjacent gneiss, felspathic, and micaceous .schists, and contain, as in the Alps and Ireland, mineral lodes ruuning along its planes of bedding.

Both in Norway and Donegal, oligoclase, as well as orthoclase, ahounds in the granite; and tbese two felspars are also found in the Protogene of Mont Blanc.

Let us suppose that the constituent minerals of an igneous rock have been carefully and conscientiously determined by the separate chemical examination of each, and that we wish to learn the percentage of each mineral that the whole rock contains.

The first and most ohvious metbod of determining this percentage, viz., by specific gravities, unfortunately only applies to mixtures of two minerals; for tbe problem of mixtures, solved by Archimedes, only furnishes two equations, and can therefore only determine two unknown quantities.*

Delesse has attempted to remedy this fatal imperfection of Archimedes' method hy the direct measurement of the volumes of the constituents of the rock. He measures, very ingeniously, the surfaces of eacb constituent exposed in the polished face of the rock, and having assumed the plane surfaces to be proportional to the volumes of the minerals present, be determines the per-eentage by weight.†

Some years ago I published, in the Journal of the Geological Society of London, and afterwards more fully in tbe Transactions of the Royal Irish Academy, a method of finding with precision, by chemical analysis, the per-centages of constituent minerals when they are not more than three in number. This method, therefore, has the advantage of Archimedes' method hy one additional equation, and though it does not apply to mixtures as complicated as those discussed by Delesse, it has greatly the advantage of his method in aceuracy, and is more easy of application.

MONTHLY NOTES.

MISCELLANEOUS.

Pick-axe without an Eye.—A new form of pick-axe, in which there is no central eye for the handle, has been introduced here from America. The blade, or actual "pick" portion of the new implement, is forged solid throughout, being thickest and strongest at the centre or crown, where, in the ordinary pick-axe, it is so much weakened hy the hole for the insertion of the handle. An iron socket is attached to the end of the wooden handle, by clongated side clipping picces, and the pick is passed through this up to its centre, when it is secured by a small iron key which is driven transversely through the socket and through a small transverse groove on the inner surface of the pick. This holds the pick and handle securely together, whilst the parts are detached when required with great facility. The strength is also much greater than in the common pick-axe, and no twisting can ever take place between the pick and the handle in striking, as the original square adjustment is always maintained. The mode of attachment also admits of the putting on a fresh pick on the instant when the one iu use requires sharpening or repair; there is also a great convenience in the new implement as regards stowage.

Lava Streams of Vesuvius.—The state of Vesuvius has been carefully investigated by the well known French philosopher, M. Sainte Clair Deville, since the recent great eruption; and the result is that he has found the velocity of the lava to be much greater than the average velocity of other lava-currents on record, the incandescent liquid having performed a distance of 1860 metres in seven hours, or nearly a yard per second. One of the most remarkable features of the lava of 1861 is the fragmentary state of all the parts whicb compose it. Even where the lava has attained a thickness of from eight to ten metres, it only presents accumulations of sharp fragments, supporting each other in the most irregular and picturesque manner. This state strongly contrasts with that of other currents which flowed down from Vesuvius during the years 1856-1858, and which consist of vitreous or resinous masses, generally of a deep black tint, strongly resembling coils of cable, and presenting no solution of continuity; so that the lava appears to form a long rope twisted into a thousand shapes, like a viscous mass issuing hy the effect of pressure from a small orifice, and curling itself up upon its own mass, so as to form various figures, hut all of a shape approaching to rotundity. The eruption which took place in 1858 yielded other currents besides, which, insinuating themselves under tbe old lava, hroke it up, and oozed out under the form of angular hlocks, like the lava of 1861. But the most interesting circumstances connected with the lava of 1858 is the manner in which it progressed along slight declivities and over horizontal planes. A perfect liquid would, in such a case, spread over the surface, filling all the interstices of the ground. Not so this lava, which rolled forward and heaved, leaving helow its surface cavities but imperfectly filled with scoriæ and ashes; in cooling, it split, leaving fissures of a depth of ahout 12 feet, in some instances, over the cavities it had formed. In a chemical point of view, the lava of 1861 appears to coutain a large quantity of amphigene, some pyroxene, mica, and a little olivine.

Action of the Living Frame upon the Magnetic Needle.—A physiological fact of great and interesting importance has recently been developed in France hy Mr Louis Lucas, showing the direct actiou of the living frame on the magnetic needle. The apparatus itself is of extraordiuary simplicity. A single element of Bunsen's hattery has its poles in communication with an electro-magnetic hohbin, surmounted by a graduated disk, bearing a magnetic needle which oscillates freely round its centre, as in the common compass. This part of the apparatus is protected hy a glass shade; the plate may he raised and lowered at pleasure by a wheel and rack. The conducting wires, after communicatiug with the hobbin, branch out towards the operator, and are connected together hy a loose metal chain. The apparatus heing in this state, the needle remains perfectly quiescent, until the operator takes hold of the cbain either with one hand or hoth, when the needle at once begins to move, describing arcs of from 10 to 90 degrees. No principle hitherto admitted iuto physical seience ean account for this strange phenomenon, and we are compelled to admit a physiological action capable of producing such motion. The experiment was varied in many ways in our presence, and we were ourselves allowed to test our individual power on the needle. That the cause of the motion was of a physiological nature was further proved hy the eircumstance that the oscillations of the needle varied in intensity according to the persons experimenting, and even aceording as the same person might he differently affected either hy tranquillity or a warm discussion, such different states naturally modifying the susceptibility of the nervous system. Stranger still, some persons present produeed the oscillations hy merely touching the chain with a glass rod about two metres in length, glass heing, as our readers know, a non-conductor. Whatever explanation may hereafter be given of M. Lucas's discovery, one fact seems even now indisputable, namely, that the human hody may directly influence the needle; what consequences may he evolved therefrom time alone can show. [We transcribe this statement for what it may be worth, hut without at all endorsing tbe alleged "indisputable fact." A certain class of mystic physicists, of whom Reichenhach may he viewed as the ehief representative, have often, and in various ways, brought forward analogous indisputable evidences of animal magnetism, for such it is, if a fact; hut in every example, capable of subsequent examination by others, explanations were found for the phenomena, on grounds already recognised by science. Most prohahly this is but a ease of Thermo Electricity.—Ed.]

Safety Locks and Keys.—In some locks lately produced by Mr Hirschfeld, the key has no "bit," hut it is provided instead with one or more circular projecting rings or collars of different diameters, formed upon the stem or shank of the key, whilst the extreme end of the key is provided with a square, or suitably shaped projection, intended to fit into a corresponding hole in a guard plate in the lock, and to turn it partly round, the rings or collars act upon corresponding moveahle notched plates or tumhlers, two of which, when three are used, are hinged to a lifting plate, which is raised by the action of the guard plate before referred to, whilst the third movcable plate or tumhler is situate hetween the other two, and is hinged or pivotted to the main lock plate. This third tumbler causes a projection, which, when the lock is ready to open, coincides witb and enters the notches in the cage of the two other tumhlers, whicb are pressed hy springs against the rings on the keys. It is thus evident that if these rings be not respectively exactly of the proper diameter, the lock cannot he opened. The main bolt is acted upon hy pins in the guard plate, and also operates the spring bolt though the intervention of a bell crank lever, carried by the main holt itself. According to another arrangement of Safety Lock and Key, suitahle either for small articles or for large safes, and wbich are constructed somewhat after the principle of the Bramah lock and key, the key itself is provided with a small "hit," and is formed with a series of slits of different depths in the end of the stem, and in the centre of those slits there is a hole or bore extending some distance down the stem from the end thereof. In the harrel of the lock there are two safety plates, one at or near the top, and the other at or near the bottom thereof, and round the barrel are arranged a number of rods or spindles held up by helical springs so as to keep their upper ends in corresponding holes in the upper safety plate. In the centre of the harrel there is a main rod or spiudle provided at its lower end, with a notched "bit," the width of the notcb corresponding with the thickness of the lower safety plate. The upper end of this central rod or spindle enters the hore of the key, and it is depressed on inserting the key by coming against the end of the bore in the key, sucb depression hringing the notch of the "bit" thereon into a position coinciding with the edge of the safety plate. During tbe insertion of the key, the ends of its several slits push forward in the several small rods or spindles through the intervention of "bits" or projections formed, through which "hits" or projections enter the slits in the key. This forward movement of the several rods or spindles releases them from the holes in the

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* Let A, B, C, &c, denote the absolute weights of the constituent minerals, and a, b, c, &c., the corresponding specific weights; while W and w are the weight of the whole specimen and its specific gravity; the equations are

$$A + B + C + \&c. = W. \quad (1)$$

$$\frac{A}{a} + \frac{B}{b} + \frac{C}{c} + \&c. = \frac{W}{w}. \quad (2)$$

† Let p, p', p'', &c, denote the measured surfaces, and d, d', d'', be the specific gravities of the constituent minerals, whi'e P, D, denote the whole polished surface and specific gravity of the rock; Delesse asserts

$$pd + p'd + \&c. = PD, \quad (1)$$

and so obtain the means of calculating the percentage by weight.

top safety plate, and when the key is extracted the bit formed upon it turns the barrel, and the "hit" on the main or central rod or spindle gives motion to the mechanism which shoots back the bolts. In locks for large safes the central rod or spindle is dispensed with, and a rod having a "bit" formed upon it is fixed to the lower part of the barrel.

SCIENTIFIC BALLOON ASCENTS.—At the meeting of the British Association, last year, a resolution was passed appointing a "balloon committee," with a grant of £200, to enable them to carry out experiments. This sum the committee proposed to expend in making four ascents—two in the present month, and two later in the year. At a meeting of the committee, held last week, it was resolved that the first two ascents should be made from Wolverhampton—the first ascent on March 22. It was desired than an altitude of five miles should, if possible, be attained. For a balloon to bold, as would in that case he necessary, between 60,000 and 70,000 cubic feet of gas, the committee negotiated with the authorities of Cremorne, but they found that no aërial vessel of this size was to be found in England. The largest, it was understood, was the Royal Normandy, which would hold nearly 50,000 feet. This balloon they therefore obtained, at the same time securing the services of Mr Lythgoe. Lord Wrottesley had made the necessary arrangements with the Wolverhamption Gas Company for a supply of gas, and on the evening of the 21st, Colonel Sykes, the chairman of the committee, Dr Lee, Mr James Glaisher, the superintendent of the magnetic and meterological departments of the Royal Observatory, Greenwich, and Mr Henry Creswick, his assistant, all arrived in the town. The observations, it was arranged, should be entrusted to Mr Creswick, who alone was to accompany the aëronaut. At 20 minutes to 2 the voyageurs ascended slowly and steadily, and, amidst the plaudits of the company, were wafted away npon a quiet breeze almost due north. After remaining for a few minntes at no great altitude the balloon was lightened, and it quickly gained a height of, it was estimated, nearly a mile. By this time the balloon had met with a counter current, and in 13 minutes after the ascent it was lost sight of, sailing in a somewhat westerly direction. A powerful telescope showed Mr Creswick busy recording his observations to the aëronaut, in what appeared to be his favourite position—seated upon the ring in the netting. The objects sought to be obtained are twofold—first, to ascertain the law of the decrease of the temperature in proportion to the elevation; and, in the next place to determine the destribution of moisture throughout the atmosphere. In order that the observations might he as complete as possible, 30 members of the Britisb Meteorological Society were engaged to make observations every ten minutes during the time it was supposed the balloon would remain up. Notes would he taken by these gentlemen at Bristol, Pembroke, Llandudno, Bangor, Lampeter, Harwarden, Manchester, Wakefield, Belvoir Castle, Grantham, Norwich, Diss, Oakham, Cambridge, Oxford, Hartwell, Glocester, Worcester, Wolverhampton, Birmingham, Derby, and Nottingham. Mr Creswick returned ahout midnight. The balloon proved utterly unsuitable for the work. A height of not more than a mile could be attained, and the machine came down from sheer inanition, and at a distance from water of not more than seven miles. The Royal Normandy had scarcely got fairly up before the gas was found to be escaping from innnmerable old rents, and the throwing ont of all the ballast was insufficient to prevent the voyageurs and the collapsing balloon from descending into a coppice at Chillington. Throngb this the machine was tugging and tearing the car and its occupants with rntbless unconcern. Smash went the delicate instruments, over which Messrs Negretti and Zambra, under the inspection of Mr Glaisher, spent so much time and pains; and it was fortunate that Mr Creswick escaped serions personal injury. This gentleman, like the aëronaut, maintained his self-possession, and was enabled to save Colonel Sykes' 60-guinea watch and the aneroid barometer from the general wreck. When the aëronaut had succeeded in effectually checking the vagaries of his treacherous craft, and tbe voyagenrs were once more on *terra firma*, such was the district in which they had been deposited that it was four hours before they could obtain a vehicle to remove the disabled balloon from the field where it lay.

IMPORTANT EXTENSION OF COPYRIGHT.—It is pretty generally known (says the *Birmingham Post)* that the Chambers of Commerce of Birmingham and Sheffield have been engaged for some time in endeavouring to effect an extension of copyright in ornamental designs. It will be seen hy the following communication, addressed to the Birmingham Cbamber, that the effort has been completely successful, a result that shows in a marked manner the practical valne of such commercial associations:—"Office of Committee of Privy Council for Trade, Whitehall, April 9. Gentlemen,—I am directed by the Lords of the Committee of Privy Council for Trade to acknowledge the receipt of your memorial, praying for an extensiou of the terms of copyright for ornamental designs applied to works in metal, and supporting your application hy the statements of manufacturers personally engaged in the several departments in that branch of trade. From the evidence thus furnished it appears that the time occupied in preliminary arrangements, and the preparation of designs previous to the mannfactured article being presented in the market, varies from six to 24 months. The majority of those by whom tbese statements are furnished ask that a period equivalent to the time tbus consumed may be added to the existing term of protectiou, thns extending the whole to five years. My Lords direct me to acquaint you that, considering a case to have been shown for the expediency of this extension, instructions have been given to the officer at the head of the Registry of Designs, to take the necessary steps for extending the copyrights of all articles in metal included in Class 1, from three yeais, as at present, to five years for the future.—I am, Gentlemen, your obedient servant, J. EMERSON TENNENT.—To the Council of the Chamber of Commerce of Birmingham and the Midland Districts."

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING MAY 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
	£	s.	D.	£	s	D	£	s.	D.	£	s.	D.
IRON.												
Bars, &c., British, per ton, ...	5	15	0	5	15	0	5	15	0	5	15	0
Nail Rods, ...	7	0	0	7	0	0	7	0	0	7	0	0
Hoop, ...	8	0	0	8	0	0	8	0	0	8	5	0
Sheets, ...	8	10	0	8	10	0	8	5	0	8	5	0
Pig, No. 1, Wales, ...	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire, ...	7	0	0	7	10	0	7	0	0	7	0	0
Rails, ...	5	7	6	5	7	6	5	7	6	5	7	6
Pig, No. 1, Clyde, ...	2	10	0	2	12	0	2	18	0	2	18	0
Swedisb in bond, ...	11	15	0	12	0	0	11	5	0	11	10	0
STEEL.												
Swedish, in kegs, ...	15	10	0	15	10	0	15	10	0	15	10	0
In faggots, ...	17	10	0	17	10	0	18	0	0	17	10	0
SPELTER, ingot, ...	17	15	0	17	15	0	18	0	0	18	10	0
ZINC, sheet, ...	23	0	0	23	0	0	23	0	0	23	0	0
COPPER,												
Sheathing bolts, pr lb., ...	0	0	11	0	0	11	0	0	11	0	0	11
Bottoms, ...	0	1	0½	0	1	0½	0	1	0	0	1	0
Old, ...	0	0	9¼	0	0	9	0	0	9	0	0	9½
Tough Cake, per ton, ...	98	0	0	98	0	0	98	0	0	98	0	0
Tile, ...	98	10	0	98	0	0	98	0	0	98	0	0
TIN.												
English blocks, per ton, duty free, ..	120	0	0	120	0	0	120	0	0	120	0	0
Bars in barrels, ...	121	0	0	121	0	0	121	0	0	121	0	0
Refined, ...	122	0	0	122	0	0	122	0	0	122	0	0
Banca, in bond, ...	125	0	0	125	0	0	124	0	0	123	0	0
Straits, ditto, ...	117	0	0	117	0	0	117	0	0	115	0	0
TIN PLATES.												
Char. IC, per box, ...	1	S	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	0	1	2	0	1	2	6	1	2	6
LEAD.												
English pig, ...	19	15	0	20	0	0	20	0	0	19	15	0
Sheet, ...	21	0	0	21	0	0	20	10	0	21	0	0
Spanish pig, in bond, ...	19	0	0	19	10	0	19	10	0	19	0	0
TIMBER—PER LOAD.												
Teak, ...	15	10	0	16	0	0	16	0	0	16	0	0
Quebec, red pine, ...	3	5	0	4	0	0	4	0	0	0	0	0
" yellow pine, ...	3	0	0	3	0	0	3	5	0	3	10	0
St. John, N.B., yellow, ...	5	0	0	5	0	0	5	0	0	5	5	0
Quebec, oak, white, ...	5	0	0	5	5	0	5	5	0	5	0	0
" Birch, ...	4	10	0	4	10	0	4	10	0	4	10	0
" Memel, ...	5	10	0	5	15	0	5	10	0	6	0	0
" Elm, ...	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak, ...	4	10	0	4	10	0	4	10	0	4	15	0
" Fir, ...	4	5	0	4	0	0	4	5	0	4	5	0
Memel fir, ...	3	10	0	4	0	0	4	0	0	4	0	0
Riga, ...	3	15	0	3	10	0	3	10	0	3	15	0
Swedish, ...	2	15	0	3	0	0	3	0	0	3	0	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce, ...	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce, ...	15	10	0	15	0	0	16	0	0	16	0	0
Yellow pine, per reduced C.												
Canada, 1st quality, ...	17	10	0	17	10	0	18	0	0	18	10	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	10	0
Archangel yellow, ...	14	0	0	14	0	0	14	10	0	14	10	0
St. Petersburgh yellow, ...	12	10	0	12	10	0	12	10	0	13	0	0
Finland, ...	9	10	0	9	10	0	9	10	0	9	10	0
Memel, ...	12	0	0	12	0	0	12	0	0	12	0	0
Gotbenburg, yellow, ...	10	0	0	11	0	0	11	0	0	11	0	0
" wbite, ...	9	10	0	9	10	0	10	0	0	10	0	0
Gefle, yellow, ...	12	0	0	11	0	0	11	0	0	11	0	0
Soderhamn, ...	11	0	0	11	0	0	11	0	0	11	0	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	0	0	23	0	0	23	0	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead, ...	22	10	0	22	10	0	22	0	0	22	0	0
White Lead, ...	26	10	0	26	10	0	27	0	0	27	0	0
Seal, pale, per 252 gallons, ...	41	0	0	41	0	0	41	0	0	41	0	0
" yellow, ...	34	0	0	35	0	0	34	0	0	36	0	0
Sperm, ...	93	0	0	92	10	0	92	10	0	93	0	0
Cod, ...	39	10	0	39	10	0	39	0	0	39	0	0
South Sea, ...	36	0	0	36	0	0	36	0	0	36	10	0
Olive, Gallipoli, per tun, ...	56	10	0	57	0	0	57	6	0	57	0	0
Palm, per tun, ...	43	0	0	43	10	0	43	0	0	43	10	0
Cocoa-nut, ...	49	10	0	50	10	0	50	0	0	50	0	0
Rape pale foreign, ...	49	S	0	49	10	0	49	0	0	49	0	0
Linseed, ...	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt., ...	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks, ...	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla, ...	34	0	0	34	10	0	34	0	0	34	0	0
Jute, ...	14	0	0	18	10	0	14	10	0	14	10	0
Hemp Rope, ...	24	10	0	24	0	0	24	0	0	24	5	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

10th March, 1862.

646. Andrew Barclay, Kilmarnock, Ayrshire—Traction engines.
647. J. B. G. M. F. Piret, Paris—Lubricating apparatus.
648. J. T. Calow, Staveley, Derbyshire—Mining machines.
649. Michael Henry, Fleet Street—Hooks and eyes.—A communication.
650. H. H. Kromschroeder, Regeut's Park.—Gas meters.

11th March, 1862.

651. Robert Peacock, Manchester—Window blinds.
652. Jean Nadal, Brooke Street—Portable fountain.
653. Edward Parfitt, Drury Lane—Watch protector.
654. William Barter, Brixham, Devonshire—Propelling vessels.
655. Edward Humphrys, Deptford—Steam engines.
656. Olivier Kerautret and Jules Kerautret, Paris—Construction of buildings.
657. E. G. Camp, Bristol—Brushes.
658. Collinson Hall, Navestock, Essex—Implement for cultivation.
659. T B. Wilson, Queen's Ferry, and William Wilson, Preston—Splitting cane.
660. Henry Baynes, Clements Lane—Bankers' cheque book.
661. Richard Smith, Glasgow—Telegraph posts.
662. George Davies, Serle Street—Artificial teeth.—A communication.
663. William Clark, Chancery Lane—Submarine operations.—A communication.

12th March, 1862.

664. A. R. Le M. de Normandy, King's Road—Gas and other pipes.
665. A. J. Russell, Edinburgh—Submarine telegraphs —A communication.
666. John Fawcett, New Swindon, Wiltshire—Cranks and crank axles.
667. W. H. Latham and F. C. W. Latham, Bolton—Tickets.
668. W. H. Latham and F. C. W. Latham, Bolton—Cutting paper.
669. Archibald Watson, Glasgow—Hot pressing apparatus.
670. John Johnson, Heaton Norris, and Samuel Morris, Stockport—Boilers.
671. William Conyers, Leeds—Currying leather.
672. Echlin Molyneux, Enniskerry, Ireland—Combustion of the fuel.
673. Paul Gondolo, Paris—Baking oven.
674. A. M. A'Beckett, Surbiton, Surrey—Railway signals.
675 William Clark, Chancery Lane—Coloured inks.—A communication.
676. Frederick Tolhausen, Paris—The colormixt top.—A communication.
677. J. E. Grisdale, Oxford Street—Photographic cameras.
678. E. G. Fitton, Ardwick, Lancashire—Winding yarn.
679. W. E. Newton, Chancery Lane—Cartridges.—A communication.

13th March, 1862.

680. J S. Hendy, Essex Street—Chimneys and chimney pots.
681. F. H. Fontaine, Paris—Chalcopantographie.
682. Lucien Vidie, Paris—Barometers and steam gauges.
683. John and Robert Cunningham, Paisley, Renfrewshire—Jacquard weaving apparatus.
684. John Hunter, Dalmellington Iron Works, Ayrshire—Furnaces.
685. Godfrey Ermen, Manchester—Receptacle for throads of tapes.
686. Henry Fletcher, Manchester—Cleaning cotton.
687. James Wadsworth, Salford—Heels for boots and shoes.
688. John Howard and John Bullough, Accrington—Warping machines.
689. E. T. Hughes, Chancery Lane—Smoke furnaces.—A communication.
690. S. V. Bonneterre, C. T. Erhart, and J. F. Monti, Paris—Regulating pressure of steam.
691. Michael Henry, Fleet Street—Stuffing boxes.—A communication.
692. R. A. Brooman, Fleet Street—Measuring gas and steam generators.—A communication
693. George Calvert, Islington—Castors.
694. S. K. Thompson, Coniston, A. T. Thompson and Samuel Mawson, Bolton le-Moors—Railway communication between guard and driver, coupling carriages, and connecting pipes and tubes.
695. J. B. Howell, Sheffield—Chains and chain cables.
696. Henry Fletcher, Wood Street—Neck ties, scarfs, and collars.
697. W. E. Newton, Chancery Lane—Armour plates—A communication.
698. Edward Bolton, Warrington—Transferring liquids.
699. Rudolph Schomburg, Cannon Street, and Adolph Baldamus, Berlin—Gas.
700. John Kent, Moscow, Russia—Cleansing and bleaching.

14th March, 1862.

701. Alexandre Quinard, Paris—Horse shoe nails.
702. Robert Garthwaite, Eldon Street, Darlington—Double tenement houses.
703. G. H. Birkbeck, Chancery Lane—Trusses or bandages.—A communication.
704. George Bennet, Manchester Buildings—Coating wrought-iron.
705. G. H. Sanborn, Boston—Gas regulators —A communication.
706. Ludwig Gabler, Bernard Street, and Maximiliau Zingler, Granville Street—Ivory.
707. G. T. Bousfield, Surrey—Digging.—A communication.
708. A. J. Paterson, Edinburgh—Telegraph cables
709. M. A. Muir and James M'Ilwham, Glasgow—Railway sleepers, chairs, and rails.
710. William Turner, Nottingham—Bakers' ovens.

15th March, 1862.

711. Alfred Coles and William Coles, Wych Street—Trusses for hernia.
712. William Clark, Chancery Lane—Brake.—A communication.
713. Harry Emanuel, Brook Street—Ornaments of personal wear.
714 C. N. Kottula, Belle Isle—Soaps.
715. G. B. Pettit, New Oxford Street—Heating liquids.
716. Julien Smadja, Stamford Street—Bustles and crinolines.
717. William M'Adam, Glasgow—Blocks, pulleys, and weights for windows.
718. James Hunter and Robert Scott, Coltness Iron Works, Cambusnethan—Reaping machines.
719. John Grant, Maidstone, Kent—Portable railways.
720. H. Y. Darracott Scott, Brompton Barracks, Chatham—Cement.
721. S. N. De la H. de Barbezieres, Paris—Horse shoe.
722. John Avery, Mark Lane—Purifying coal.—A communication.
723. George Hamilton, Islington—Tumbler locks.
724. James Robey, Hereford Road North—Refining sugar.
725. William Pickstone. Radcliffe, Lancashire—Piled fabrics.
726. J. T and T. Pendlebury, Bury, Lancashire—Lubricator.

17th March, 1862.

727. William Clark, Chancery Lane—Water meters —A communication.
728. A. S. and A. R. Stocker, Wolverhampton.—Articles to be worn by bipeds and quadrupeds.
729. W. E Gedge, Wellington Street—Crinolines.—A communication.
730. W. B. Lord, Plymouth, and F. H. Gilbart, Brixton—Raising and lowering.
731. L. P. Mongruel, Paris—Cold vapour generator and carburation of gas.
732. William Bowser, Glasgow—Ships' hearths or cooking apparatus.
733. George Davies, Serle Street—Drawing.—A communication.
734. John and William Weems, Johnstone, Renfrewshire—Pressure and discharge of fluids.
735. Brereton Todd, Falmouth, Cornwall—Antimony.
736. William Barford, Peterborough—Rolling land.
737. William Barber, Stockport, Cheshire—Hats.
738. G. T. Bousfield, Brixton—Crank sewing machines —A communication.
739. J. M. Courtauld, Braintree, Essex—Power looms.
740. James Hicks, Hatton Garden—Mercurial barometers.
741. Ephraim Smith, Carlisle Street—Watch keys.
742. William Gossage, Widness, Lancashire—Soda and potash.
743. Thomas Waller, Conduit Street West—Fire-arms.—A communication.
744. Thomas Myers, Brighton, Sussex—Meters.

18th March, 1862.

745. M. A. F. Mennons, Paris—Arresting runaway horses.—A communication.
746 M. A. F. Mennons, Paris—Safe for provisions.—A communication.
747. M. A. F Mennons, Paris—Paper pulps —A communication.
748. M. A. F. Meunons, Paris—Needle threading.—A communication.
749 James Banks, Salisbury Street—Telegraph printing.
750. Henry Bailey, Common Street—Paper.—A communication.
751. Thomas Dunn, Pendleton—Bridges, roofs, and houses.
752. William Tongue, Bradford—Dressing and combing flax, &c.
753. Charles Hes, Birmingham—Umbrellas and parasols.
754. A. A. Beaumont and J. A. Escalier, Paris and London—A flying top.
755. J. A. Jaques and J. A. Fanshawe, Tottenham, and Frank Jaques, Draylesdon—Rollers.
756. J. A. Ronketti, Northampton Road—Meteorological instruments and thermometers.
757. James Wright, Bridge Street, and Henry Wheatcroft, Fore Street—Shoes.
758. Samuel Slack, Nottingham—Stockings and knitting machines.
759. Frederick Warner, Crescent, Criplegate—Cocks or taps.
760. R. A. Brooman, Fleet Street—Barytic products and sugar.—A communication.
761. J. T. Buck, New North Road—Ladies' companions.

19th March, 1862.

762. Alfred Krupp, Rhenish Prussia—Shafts for steam boats.
763. Robert Hadfield and Jabez Shipman, Sheffield—Crinoline steel.
764. Spendlove Deshorough, Noble Street—Needles.
765. Robert Wilson, Patricroft, near Manchester—Hydranlie presses.
766. Sampson Moore, Liverpool—Cutting tobacco.
767. R. A. Brooman, Fleet Street—Inks and colours.—A communication.
768. R. A. Brooman, Fleet Street—Guipure lace and embroidery.—A communication.
769. R. A. Brooman, Fleet Street—Rotary engines.—A communicatiou.
770. R. A. Brooman, Fleet Street—Chain cables and capstans.—A communication.
771. John Cumming, Edinburgh—Distributing type.
772. G. M. Todd, Hackney Road—Sewing machine.

20th March, 1862.

773. Bernard Samuelson, Banbury, Oxford—Chain harrows.
774. J. G. T. Campbell, Old Kent Road—Ships' propellers.
775. Albert Hill, Cheddar, Somersetshire—Fastenings for stays.
776. R. M. Roberts, Kensington—Motive power.
777. Edwin Smith, Sheffield—Cutting stone, and modelling.
778. Edward Field, Buckingham Street—Flow of fluids.
779 William Baddeley, Islington—Tobacco.—A communication.
780. William Clark, Chancery Lane—Soap —A communication.
781. J. G. Thompson, Madras, East Indies—Pianofortes and harmoniums.

21st March, 1862.

782. D. E. Siebe, Mason Street—Refrigerating or producing cold.
783. Robert Kay, Castleton Print Works, Lancashire—Printing calico
784. W. J. Curtis, Tufnall Park Road—Apparatus to point the fares of vehicles.
785. James Newall, Bury, Lancashire—Supplying gas.
786. J. M. Hart, Cheapside, and Robert Lavender, Goswell Road—Generating steam.
787. James Fawcett, Wakefield—Soap.
788. James Humphrys, Tower Hill—Steam engines.
789. B. H. Mathew, Saint James'—Fire-arms and cartridges.
790. William Phelps and W. R. Lymbery, Nottingham—Woven fabric.
791. J. and W. Warbriek, and Alfred Travis, Dukinfield, Cheshire—Carding engines.
792. William Clark, Chancery Lane—Sewing machines.—A communication.

22d March, 1862.

793. David Abercrombie, Glasgow—Power looms.
794. Thomas Marsh, West Bromwich, Staffordshire——Hames for horses.
795. Toni Fontenay, Grenoble, France—Smoke consuming furnaces.
796. Evan Owen, Bala, North Wales—Turbines.
797. Edward Lord, Todmorden, Yorkshire—Preparing cotton.
798. John Davis, Kennington, Surrey—Wind musical instruments.
799. Robertson Gladstone, Broad Green, Lancashire—Tipping waggons.
800 F. W. Colls, Deptford, and Peter Haden, Hackney—Consuming smoke.
801. J H. Tuck, Cannon Street—Flexible valves.
802. J. G. Jennings, Holland Street—Biscuits.
803 T. M. Smith, High Street—Candles.
804. T. F. Hale, Bristol—Valves.
805. William Holiday, Bradford—Press plates.
806. George Hartshorne and D. G. Ward, Dudley, and William Woolley, Tipton, Staffordshire—Perforating metal.
807. Michael Henry, Fleet Street—Kilns and furnaces.—A communication.

24th March, 1862.

808. J. H. Brierley, Halifax, Yorkshire—Clasp for belts.
809. John Clarke, Shiffnal, Salop—Carriage axles.
810. Thomas White, Birmingham—Nut crackers.
811. S. E. Turner, Birkenhead, Cheshire—Gas.
812. C. M. Moullier, Paris—Cables or chains.
813. Benjamin Fleet, East Street—Bottling soda water.

814. John Topham, Nottingham—Incrustation in steam boilers.
815. Edmund Morewood, Stratford, and Andrew Whytock, St. Martin's Lane—Coating metals.
816. William Henson, Nottingham—Knitting machinery.
817. John Stewart, Glasgow—Cards for jacquard weaving.—A communication.
818. M. A. F. Mennons, Paris—Embroidery.—A communication.

25th March, 1862.

819. Echlin Molyneux, Enniskerry, Ireland—Air engines.
820. A. H. Renton, Chelsea, and Edward Cottam, Pimlico—Steering ships.
821. Walter Beaumont, and J. W. Edge, Manchester—Sights for rifles
822. Alfred Fryer, Manchester—Sugar.
823. A. M. Silber, Wood Street—Fastening for purses.—A communication.
824. Theophile Guibal, Mons, Belgium—Ventilators.
825. Edmund Morewood, Stratford, and Andrew Whytock, St. Martin's Lane—Iron.
826. William Palmer, Sutton Street—Lamps.
827. Charles Culling, Norfolk—Fire-arms.
828. William Clissold, Stroud, Gloucester—Carding engines.
829. J. T. Loft, Berwick Street—Covering metal and wire.

26th March, 1862.

830. L. De la Peyrouse, Panton Square—Preservation of animal substances.
831. J. H. Johnson, Middlesex and Glasgow—Cleaning flues of steam boilers.—A communication.
832. John Wilson, Glasgow—Hot pressing.
833. James Parker, Huddersfield—Steam engines.
834. W. J. Taylor, Upper Church Street—Portland cement.
835. Henry Nunn, Chelsea—Mangles.
836. Robert Boby, Bury St. Edmunds—Hay making machines.
837. James Boothman, Gisburn, Yorkshire—Bee hives.
838. John Taylor and C. H. Minchin, Manchester—Gallery for gas lights.
839. Henry Carr, Victoria Street—Lubricating.
840. Robert Griffiths, Mornington Road—Weapons for naval warfare.

27th March, 1862.

841. W. L. Winans, Brighton—Mounting ordnance.
842. A. V. Newton, Chancery Lane—Colouring matters.—A communication.
843. John Haworth, Southampton Street—Telegraphic signals.
844. William Greenway, Birmingham—Bolts for doors.
845. J. D. Schneiter, Paris—Printing letters, maps, and preserving printing surfaces.
846. T. G. Greenstreet, Kennington Road—Window sashes.
847. Frederick Tolhausen, Paris—Cigar tubes.—A communication.
848. Richard Edwards, Regent Street—Pulverizing mineral substances.
849. W. F. Heuson, New Cavendish Street, and H. H. Henson, Parliament Street—Wicks for candles.
850. James Lock, Nassington, Northamptonshire—Stacking straw.
851. E. H. C. Monckton, South Kensington—Effervescing liquids.
852. J. L. H. Clemence, Paris—Treating cocoons of silk worms and paper.
853. R. A. Brooman, Fleet Street—Combing vegetable fibres.—A communication.
854. Robert De Bary, Finsbury Square—Cigars.—A communication.
855. John Easterbrook and J. H. Allcard, Sheffield—Vices.
856. W. E Gedge, Wellington Street—Extinguishing fire.—A communication.
857. S. A. Emery, Arundel Street—Soap.
858. J. H. Johnson, Middlesex and Glasgow—Thrashing machines.—A communication.
859. W. F. Smith and Arthur Coventry, Salford—Lathes.
860. G. H. Birkbeck, Chancery Lane—Imitation mosaics.—A communication.

28th March, 1862.

861. George Allcroft, Church Row—Pressure gauges.
862. James Jones, Warrington—Raising and forcing liquids.
863. W. A. Ashe, Bolton Place—Propelling vessels.—A communication.
864. W. B. Nation, Battersea—Boxes or cases.
865. R. A. Owen, Manchester—Screw propellers.
866. E. T. Nonalhier, Paris—Ventilator.
867. Antonio Lucetti, Glasgow—Expressing juice from fruit.
868. J. H. Johnson, Middlesex and Glasgow—Chaff cutters.—A communication.
869. Edmund Smith, Hamburg—Wet gas meters.
870. Robert Lublinski, City Road—Crutch hooks on umbrellas.

29th March, 1862.

871. Robert Kay, Castleton Print Works, Lancashire—Printing calicoes.
872. John Boucher, Surrey Villas—Fire-arms and projectiles.
873. Youngs Parfrey, Pimlico—Fire-arms.
874. William Clarke, Gateshead, Durham—Casting.
875. Israel Morris, Essington, Staffordshire—Cultivating land.
876. C. H. Townsend, James Young, and James Hankins, Bristol—Steam boilers.
877. Narcissus Smith, Great Quebec Street—Fire engine
878. William Glass, Prince's Street—Sulphuret of antimony.
879. Thomas Cole, Coventry—Figured ribbons.
880. William Paterson, Glasgow—Iodine.
881. Richard Smith, Melkshan, Wiltshire—Roller blind apparatus.
882. John Baker, Old Kent Road—Alimentary preparations.
883. E. B. Hart, New York, U.S.—Cutting cork.—A communication.
884. John Platt and William Richardson, Oldham—Carding engines.
885 W. E. Newton, Chancery Lane—Accoustic apparatus.—A communication.

31st March, 1862.

886. John Clinton, Percy Street—Flutes.
887. M. A. F. Mennons, Paris—Fermentable sugar.—A communication.
888. John Jordan, Liverpool—Armour plated vessels.
889. Robert Young, Glasgow—Cleaning and drying grain.
890. Nathan Frankenstein, Clarendon Villas—Cutting corks.—A communication.
891. William Tyler, Birmingham—Feeding dogs and poultry.
892. W. H. Hook, Walworth—Folding envelopes.
893. J. P. Woodbury, Boston, U.S.—Arming war vessels.
894. W. B. Lord, Plymouth, and F. H. Gilbert, Brixton—Flame slip.
895. W. B. Lord, Plymouth, and F. H. Gilbert, Brixton—Loading fire-arms.
896. Richard Burley, Lower Thames Street—Lining the bearing of axles.
897. R. C. Ransome, Ipswich—Thrashing machinery.
898. Robert Nightingale, Maldon, Essex—Markers, butts, or mantelets.
899. L. E. Schmolle, Upper John Street—Crinolines.
900. John Harding, Leeds—Heating air, calcining and smelting iron.
901. J. M. Clements, Birmingham—Sewing machines.
902. J. H. Johnson, Middlesex and Glasgow—Rotatory engines.—A communication.
903. Henry Pooley, Liverpool—Weighing machines.
904. W. M'I. Cranston, King William Street—Cutting crops.—A communication.

1st April, 1862

905. J. T. G Stone, Hoxton—Bustle and petticoat.
906. P. R. Couchoud, Paris—Loom for chenille and lace-work.
907. C. P. Gontard, France—Watches and time keepers.
908. William Clark, Chancery Lane—Manure.—A communication.
909. William Clark, Chancery Lane—Kneading machines.—A communication.
910. Michael Henry, Fleet Street—Furnace for treating iron ore.—A communication.
911. William Turner, Hockley, Nottingham—Fermented dough.
912. Frederick Knudsen, Cockspur Street—Chronometers.
913. Henry Smith, Stockton-on-Tees—Casting iron
914. J. H. Johnson, Middlesex and Glasgow—Spinning cotton.—A communication.
915. H. W. Caslon and George Fagg, Chiswell Street—Casting types.
916. H. W. Whitehead and George Bray, Leeds—Carding wool.
917. Edmund Hartley, George Little, and John Hinchcliffe, Oldham—Metal shafts.
918. John Platt and William Richardson, Oldham—Spinning mules.
919. H. J. Madge, Swansea—Coating iron plates.
920. John Platt and William Richardson, Oldham—Motive power.
921. Herman Lorenz and Theodor Vette, Berlin, Prussia—Filters.

2d April, 1862.

922. W. C. Harrison, Pimlico, and H. J. Standly, Cockspur Street—Boring rocks.
923. George Holcroft, Manchester—Blast furnaces.
924. George Scratton, Stickney, Lincoln—Blinds for windows.
925. Samuel Warren, Ledbury, Hereford—Transmitting motion.
926. R. A. Brooman, Fleet Street—Pocket books.—A communication.
927. William Malam, Skinner Street—Gas.
928. A. V. Newton, Chancery Lane—Bits for taming horses.—A communication.
929. George Collier and John Collier, Halifax, Yorkshire—Looms.
930. Bewicke Blackburn, Adelphi—Lubricating.
931. Samuel Hunter, Newcastle-upon-Tyne—Anchors.
932. Thomas Moore, Regent Circus—Winding apparatus.
933. J. T. Loft, Berwick Street—Printing in colours.
934. William Clark, Chancery Lane—Manifold writing.—A communication.
935. William Leopard, Hurstpierpoint, Sussex—Railway brake apparatus.
936. William Clark, Chancery Lane—Carbonic acid.—A communication.

3d April, 1862.

937. Gustave Rebour, Paris—Autographic log
938. William Helme, Caldbeck, Cumberland—Fire-lighters.
939. Robert Morton, Stockton-on-Tees—Refrigerators.
940. George Bower, Ashton-under-Lyne, and John Qualter, Dukinfield—Metallic pistons.
941. John Newton Montpellier Road—Breakwaters and piers.
942. George Hunter, Coleford—Cutting and planing stone.
943. R. M. Toogood and John Laybourne, Newport—Railway crossings.
944. William Kemp, Spital Square, and Thomas Cowley, Harts Lane—Silk pile velvet.
945. Mark Amos, Westbury-on-Tryn—Harrows.
946. David Wilson, Wandsworth Common, and E. A. Cowper, Great George Street—Pressing cotton.
947. Joseph Lee, Lincoln—Traction engines and boilers.
948. Alexander Mann, Tottenham—Photographic apparatus.
949. W. A. Richards, Cornwall Place, Holloway—Bags and locks for bags.
950. H. T. Hassall, Birmingham, and Michael Burke, Liverpool—Invalids' and ships' chairs.

4th April, 1862.

951. J. F. Woodall, Orchard Street—Ventilating carriages.
952. J. C. Kay and William Hartley, Bury—Steam engines.
953. Francis Spencer, Pendleton, Lancashire—Looms.
954. William Ryder, Bolton-le-Moors—Forging metals.
955. F. C. Bakewell, Hampstead—Letter printing machines.—A communication.
956. Thomas Silver, Philadelphia, U.S.—Governors.
957. Leonard Lindley and Frederick Taylor, Nottingham—Sewing machines.
958. Henry Fletcher, Camden Road—Valves for hydraulic presses.
959. George Moulton, Manchester—Pentagraph machines.
960. Andrew Woodhouse and Thomas Hunter, Hindpool—Kilns and stoves
961. A. J. Hale, William Street—Drawing ovals.
962. Matthew Butcher, Norfolk—Reefing and furling sails.
963. S., S., R., and T. Fielding, Smallbridge, Lancashire—Lubricating valves.
964. R. A. Brooman, Fleet Street—Case for reels of cotton.—A communication.
965. Jaffray Sceales, Lloyd's—Steering ships.
966. W. E. Newton, Chancery Lane—Iron and steel.—A communication.
967. W. E. Newton, Chancery Lane—Pumps for ships.—A communication.
968. W. E. Newton, Chancery Lane—Projectiles.—A communication.
969. John Nock and W. K. Price, Birmingham—Gas cooking ranges.
970. J. D. Humphreys, Barnsbury—Furnaces.
971. Mowbray Walker, Gracechurch Street—Fire-arms.

5th April, 1862.

972. William Begg, Preston—Furnace bars.
973. H. J. Simlick, Wellington Row, Middlesex—Cigar lights.
974. John Colling, Seaham, Durham—Reefing sails.
975. Alexander Clark, Gate Street—Window shutters.
976. Leopold Faconnet, Paris—Tiles.
977. R. A. Kobitzoch, Bucharest, Wallachia—Diving apparatus.
978. Thomas Critchlow, Bolton le-Moors—Planing machines.
979. Benjamin Thompson, Walker, near Newcastle—Steam engines.

7th April, 1862.

980. C. S. Duncan, Bayswater—Ventilating or suppressing fire.
981. Titus Smith, Salford—Screw bolts.
982. William Simons, Renfrew—Ships or vessels.
983. Alfred Harris, Birmingham—Gun barrels.
984. Edward Welch, Stratford-on-Avon—Stoves, grates, and ovens.
985. George Haseltine, Fleet Street—Lamps.—A communication.
986. W. N. Nicholson, Newark, Nottinghamshire—Ranges and stoves.
987. Thomas Jackson, Orchard Street—Pianofortes.
988. Joseph Watremez and Aloys Kloth, Aix-la-Chapelle—Indicators.
989. James Carrington, Kensington—Paving stables.

8th April, 1862.

990. William Steven, Glasgow—Moulding bricks.
991. James Brown, Aldgate—Protecting bottoms of ships.
992. William Beardmore, Glasgow—Steam rams.
993. Hugo Levinstein, Old Broad Street—Lustering silk.
994. John Whitehouse, Birmingham—Door knobs and ornaments.
995. The Hon. W. E. Fitz Maurice, Hyde Park Gate—Ships' batteries
996. C. P. Carter, Kennington Hall, Kent—Instrument for inserting photographic pictures into or removing them from between the "mounts" of albums.

997. F. W. Brearey, Cornhill—Medicated cups.
998. E. H. C. Monckton, South Kensington—Timekeepers.
999. John Jaques, junior, Hatton Garden—The game of croquet.
1000. Benjamin Sharpe, Hanwell Park—Harrows and rakes.
1001. H. A. Holden, Birmingham, and Charles Weekes, Carmarthen—Drawing water.
1002. E. B. Sampson, Stroud, Gloucestershire—Oiling and carding wool.
1003. John Lawson, Leeds—Balling cotton and thread.—A communication.
1004 James Wright, Bridge Street—Armour plates.
1005. Thomas Cobley and James Wright, Bridge Street—Treating ores.

9th April, 1862.

1006. Samuel Rodgett, Blackburn, Lancashire—Power looms.
1007. J. E. H. Andrew, Andenshaw, Lancashire—Looms.
1008. Squire Farron, Ashton-under-Lyne—Regulating steam.
1009. George Hollinshed, Salford—Sandwich cases.
1010. J. & J. Bullough, Baxenden, Lancashire—Looms.
1011. William Taylor, Oldham—Spinning.
1012. William Davies, Llanelly, South Wales—Puddling furnaces.
1013. Josiah Jones, junior, Liverpool—Arming ships.
1014. John Langston, Strood, Kent—Portland cement.
1015. Colin Mather, Bronghton, Lancashire—Spittoons.
1016. John Knowelden, Southwark—Engines.
1017. W. E. Newton, Chancery Lane—Raising and forcing liquids.—A com.
1018 William Mays, Joseph Street—Grinding grain.
1019. Robert Theyson, Hanover—Cork cutting machinery.

10th April, 1862.

1020. Edward Funnell, Brighton—Signal for railways.
1021. Daniel Fryer, Carlton Square, and W. J. Williams, Arundel Street—Gas.
1022. William Armitage, Manchester—Looms.
1023. William Nunn, Saint George Street—Lanterns.
1024. John Houghton, Foster Lane—Improved haversack.
1025. Alexander Banbridge, Ireland—Swing bridges.
1026. John Lillywhite, Seymour Street, and Thomas Nixon, Chelford—Cricket balls
1027. C. P Coles, Southsea—Masts for ships.
1028. G. D. Mertens, Margate—Beer.—A communication.
1029. Louis Christoph, Paris, William Hawksworth, Linlithgow, and G. P. Harding, Paris—Drawing metals.
1030. Henry Deacon, Appleton, Lancashire—Caustic soda.
1031. John Platt, William Richardson, Oldham, and William Holland, Salford—Carding engines.
1032. John Petrie, junior, Rochdale—Blowing and exhausting air.
1033. George Burge, Albert Road—Protecting forts, ships, &c.
1034. Charles Bartholomew, Broxholme, and John Hepinstall, Masbrough—Blooms.
1035. Osborne Reynolds, Debach, Suffolk—Building ships.
1036. T. B. Daft, Queen Square—Coverings for the feet.
1037. William Fox, Amiens, France—Brooms and brushes.
1038. Andrew Trimen, Adam Street—Protection of stones.

11th April, 1862.

1039. Henry Holland, Birmingham—Umbrellas and parasols.
1040. J. T. Grice, Birmingham—Metallic tubes.
1041. E. H. Carbutt, Bradford—Pistons.
1042. John Garnett, Windermere—Washing photographic pictures.
1043. W. E. Gedge, Wellington Street—Lamp for mines.—A communication.
1044. J. F. Mathias, Paris—Ironing straw hats.
1045. Francois Rigollot, Paris—Pegs for boots and shoes.
1046. J. M. Landmann, Algiers, Algeria—Hydraulic engines.
1047. T. & W Knowles, and J. & W. Houghton, Gomersal, Yorkshire—Looms.
1048. Ellis Butterworth, Calder Cottage, near Rochdale, Lancashire—Cops of yarn.
1049. William Clark, Chancery Lane—Leathern accoutrements.—A communication.
1050. William Bush, Tower Hill—Ships and shields.
1051. J. H. Johnson, Middlesex and Glasgow—Fire arms.—A communication.
1052. James Howard, E. T. Bousfield, and Thomas Philips, Bedford—Steam cultivation.
1053. Isaac Whitesmith, Glasgow—Power looms.

12th April, 1862.

1054. Joseph Bunnett, Deptford, Kent—Revolving shutters.
1055. Nicholas Nussey, Holbeck, near Leeds—Combing wool, &c.
1056. Ernest Bollee, France—Hydraulic ram.
1057. Andrew Sweet, Hampstead Road—Locks and latches.
1058. Edgar Drewett, Blackheath, Kent—Bottles.
1059. A. S. Campbell, Hampstead—Surface condensers.
1060. A. S. Campbell, Hampstead—Refrigeration of liquids.

14th April, 1862.

1061. James Park, Bury—Steam engines.
1062. Edward Peyton and W. F. Batho, Birmingham—Angle iron.
1063. J. F. Spencer, Newcastle-on-Tyne—Steam engines.
1064. H. C. Lee, Lawrence Poultney Lane—Knitting machines.
1065. Frederick Tolhansen, Paris—Telegraphic dial printing.—A communication.
1066. John Beard, Leonard Stanley, Gloucestershire—Sofa beds.
1067. J. M. French, Birmingham—Pianofortes.
1068. John Darlington, Gresham Street—Telegraphic wires and cables.
1069. J. K. Hampshire, Whittington, Derbyshire—Safety cage.
1070. John Dargue, Bradford—Combing wool.
1071. Charles Harratt, Hornsey Lane—Masts, yards, and booms.
1072. James Childs, Victoria Street—Wax matches.
1073. R. A. Brooman, Fleet Street—Reaping machines.—A communication.
1074. R. A. Brooman, Fleet Street—Carriages.—A communication.
1075. R. A. Brooman, Fleet Street—Pumps.—A communication.
1076. R. A. Brooman, Fleet Street—Hobby horse.—A communication.

15th April, 1862.

1077. C. J. Coxhead, Kentish Town—Pianoforte actions.
1078. George Fell and William Haynes, Bolton—Manufacture of leather.
1079. Jacob Taylor, Oldham—Preparing cotton.
1080. T. H. Bennett, Southwark—Hats and caps.
1081. F. A. Le Mat, New Orleans, U.S., and C. F. Girard, Washington, U.S.—Fire arms.
1082. Richard Roche, Southsea, Hants—Gun carriages.
1083. C. R. Heap, Great George Street—Railway chair.—A communication.
1084. A. V. Newton, Chancery Lane—Blasting powder.—A communication.
1085. George Bedson, Manchester—Wire ropes.
1086. John Platt and William Cheetham, Oldham—Looms.
1087. John Platt and William Richardson, Oldham—Cleaning wool.
1088. R. A. Peacock, St Helier, Jersey—Lock gates for docks.
1089. William Clark, Chancery Lane—Ornamenting fabrics.—A communication.
1090. T. W. Gray, Fenchurch Street—Explosive compounds.—A communication.
1091. F. C. Philippson, Berlin, Prussia—Steam hammers.—A communication.
1092. James Crossdale, Rotherfield Street—Boots and shoes.
1093. Rupert Rains, Bridge Street—Freezing and churning.—A communication.

16th April, 1862.

1094. Stephen Barrett, Clifton Street—Projectiles.
1095. F. N. Gisborne, Adelaide Place—Electric targets.
1096. Thomas Edwards and Joseph Harrison, Liverpool—Letter boxes
1097. John Barbour, Liverpool—Upholsterers' hammers.—A communication.
1098. W. F. Lock, Isle of Wight—An elongated projectile.
1099. J. W. Hadwen, Halifax, Yorkshire—Treatment of silk waste.
1100. David Stott, Stainland, Yorkshire—Rings from paper.
1101. James Mackay, Liverpool—Projectiles.
1102. J. M. Rowan, Glasgow—Articles of cast steel.
1103. R. & R. Cochran, Paisley—Ornamental fabrics.
1104. F. P. Warren, Cosham, Hants—Steering vessels.
1105. Matthew Cartwright, St John's Row—Plates for artificial teeth.
1106. W. J. Marsden, Sheffield—Eye shades.
1107. W. E. Newton, Chancery Lane—Artificial teeth.—A communication.
1108. W. E. Newton, Chancery Lane—Cannon.—A communication.
1109. John Stanton, Birmingham—Piercing metal washers.
1110. J. H. Johnson, Middlesex and Glasgow—Cutting teeth of wheels.—A com.
1111. John Ashbury, Manchester—Railways.
1112. J. H. Johnson, Middlesex and Glasgow—Carriages.—A communication.
1113 J. W. Ford, Shooters Hill—Sewing machines.—A communication.
1114. John Weston, Upper Whitecross Street—Morticing tools.

17th April, 1862.

1115. C. D. Abel, Southampton Buildings—Potash and soda.—A communication.
1116. Alfred Krupp, Essen, Prussia—Screw propellers.
1117. Victor Flenry, Paris—Clocks and time keepers.
1118. W. H. Hutchinson, Bury, Lancashire—Ammonia from refuse gluten.
1119. John Griffiths, Liverpool—Propelling vessels.
1120. William Harling, J. M. Todd, and Thomas Harling, Burnley—Looms.
1121. Frederick Tolhansen, Paris—Bricks and tiles.—A communication.
1122. James Murphy, Glasgow—Looms.
1123. J. P. Temperley, Bolton-le-Moors—Air pumps.
1124. G. T. Bousfield, Brixton—Sewing machines.—A communication.
1125. J. L. Perin, Paris—Mortising wood.
1126. Henry Gardner, Leeds—Preparing flax.
1127. C. D. Abel, Southampton Buildings—Alloys containing cadmium.—A com.
1128. R. A. Brooman, Fleet Street—Taps and valves.—A communication.
1129. R. A. Brooman, Fleet Street—Buffing apparatuses.—A communication.
1130. William Anderson, Shaftesbury Street—Steam generators.
1131. Henry Gallagher, Bermondsey, Surrey—Leggings or overboots.
1132. Samuel Rideal, Manchester, and Robert Shepherd, Great Grimsby—Railway breaks.
1133. William Clark, Chancery Lane—Railway rails.—A communication.
1134. J. C. Rivett, Farnworth, and J. M. Hetherington, Manchester—Preparing cotton.
1135. Ralph Wedgwood, Barnes, Surrey—Saving life in cases of fire.

19th April, 1862.

1136. Robert Dennison, Lancaster—Reaping machines.
1137. Edwin Dove, Hunter Street—Matches and fusees.
1138. J. S. Phillips, Finchley Road—Propulsion of vessels.
1139. John Shanks, Barrhead, Renfrewshire—Ventilation.
1140. Moses Masters, New Kent Road—Artificial legs.
1141. R. and G. Stuart, and Henry Hill, Sheffield—Flyers.
1142. Benjamin Rhodes, Old Ford Road—Cylinders and vessels.
1143. Walter Munn and David Ballantine, Borrowstounness, Linlithgow—Mills.
1144. Benjamin Browne, King William Street—Fire arms.—A communication.
1145. Edward Loysel, Cannon Street—Locks.
1146. William Rose, Hales Owen, Worcestershire—Barrels of fire arms.
1147. Alexander Parkes, Birmingham—Rollers for printing.
1148. A. N. Wornum, Store Street—Pianofortes.
1149. Alexander Parkes, Birmingham—Surface condensers.
1150. Henry Lumley, Chancery Lane—Improved rudder.

21st April, 1862.

1151. A. P. Tronchon, Paris—Hop-es, fruit walls, &c.
1152. James Combe, Belfast—Hackling flax.
1153. E. H. C. Monckton, South Kensington—Apparatus to be used in warfare.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 15th April, to 6th May, 1862.

April 15, 4465 H. F. B. Macnamara, C.E., Colchester—"Self-acting Ventilator."
" 17, 4466 Richard Stevens, Hungerford-market, W.C.—"Miniature Billiard Table and Stand."
" 22, 4467 Wm. W. Ronch, Strand, W.C.—"Instantaneous Photographic Shutter."
" 24, 4468 Wm. Spurrier, Birmingham—"Egg Frame with Warmer."
" 25, 4469 A. J. Marriott, Oxford Street, W.—"Safety Screw Guard for Brooches, Pins, Ear-rings, &c."
" " 4470 Aaron Solomons, Old Change, E.C.—"Harmozon Corset."
" 26, 4471 J. M. Hagenbuck, Caroline Terrace, Dalston, N.E.—"Exhibition Cigar Holder."
" 30, 4472 T. H. & J. Small, Great Marlborough Street, W.—"Pillar Foot Lathe."
" " 4473 R. & C. Cuff, Cockspur Street, S.W.—"Anti-crib Biting Muzzle for Horses."
May 5, 4474 W. H. Blanch, Liverpool—"Combined Rifle Ball and Powder Holder."
" 6, 4475 Jas. Tasman, Grocer's Hall Court, Poultry, E.C.—"An improved Trunk."
" " 4476 James Lamb, Furnival Street, and Harry Holdsworth & Co., New George Street, Sheffield—"Clasp or Clip for Crinolines."
" 8, 4477 James Cocks, Cornhill, E.C.—"Double-breasted Waistcoat."
" " 4478 James Cocks, Cornhill, E.C.—"Improved Shooting-Coat Pocket."
" 10, 4479 I. Timmins & Co., Birmingham—"Improved Oil Can."
" 13, 4480 Thomas Aldred, Oxford Street, W.—"New Lever Check-Winch for Fishing."

PROGRESS OF THE EXHIBITION.

ART. II.

Another month has passed, and even still, the work of arrangement and display, of this gigantic collection, is not quite complete. Immense progress and improvement have however marked the interval, and now we do, indeed almost at times, forget the building, with all its sins and shortcomings, real and imaginary; dazzled and amazed, with its grand and multifarious and brilliant contents.

There is no "cant" in saying that no reflecting man can walk through the raw products, of the east annexé, and of many of the Colonial and Foreign Courts, amongst the latter notably of the Hungarian Court; can behold the rich wheat of our antipodes, some, it is said, weighing 10 lbs. to the bushel more than the very best grown upon our old soil of England, the wines and oils of Southern and Eastern Europe, the countless magnificent timbers and richly coloured woods, of our own Colonies in tropical lands, without some such scarce articulate thoughts, as found utterance with the Hebrew shepherd, poet, and king, of old, "Thou makest us to drink of the river of thy goodness." The torrent of Nature's bounty here displayed is indeed overwhelming.

Two shilling days have passed as we write, and already the paying visitors have nearly doubled in number—the hard heads and horny hands have now begun to arrive. Those whose habits and bread knowledge (as the German's say) will enable many of them, better to appreciate what they shall see, and to learn from it, than the many of the Lord Dundreary tribe, whom so far it has been almost humiliating to see clustering like insects about honey—round the gems and diamonds from morning till night—passing all else but these bits of concrete mammon, with "ennui."

Those connected with or interested in all of our mechanical arts, will find in the western annexé, the grandest and most instructive display that has been ever presented—far exceeding in this department anything of 1851, or Paris in 1855. The engineer and mechanician will soon find objects enough of interest, and some of novelty to rivet his attention.

The "expert" will probably join with us in the general conclusions, that on comparing the display of machinery, and of metallic products in the first stage of manufacture, in 1851, and now; the Foreign Exhibitors show a decisive and remarkable improvement, in materials, in design, in execution; but, that with a few exceptions as regards the first, they are still a good deal behind ourselves. As respects our own displays, there is very much less to mark difference, or to prove corresponding advance during eleven years by ourselves. Our workmanship is still the best—Whitworth's tools, in design, grace of form, perfection of execution, still stand the first in the world; but, if we go up to the extreme north-east end of the annexé, we shall see machinery of the same sort—Planing Machines, Tube Cutting Engines, Lathes, &c., from Schemnitz, and by Zimmerman, better than many British tools exhibited, and not so very far behind even those of Whitworth.

If we pass to products in the first stage of manufacture, we shall have to confess ourselves fairly and completely overpassed and beaten.

We can show nothing to compete with Krupp's gigantic masses of the very finest steel. Here are the two halves of an ingot broken through cold by blows of his huge steam hammer, (the weight of which, and length of stroke, we have heard appraised at something that sounds quite fabulous) but which must be an unequalled tool to fracture a cylindrical mass of cast steel of more than a yard in diameter at one or even by many blows; here are guns of 12 to perhaps 18 tons of cast steel in a single mass, without flaw or blemish, and bored out like a mirror; double crank shafts proportionately large; huge slabs and cylinders split right up by wedges, to show the absolute homogeneity and solidness of the metal; others more than a foot thick, bent right double and close, without a crack in the extended side.

Our steel manufacturers present nothing comparable—not even the more favourably placed displays, of Bessemer and others. Truly we need look to ourselves, if we are to maintain our manufacturing position in the world, or another ten years may find us in many other respects also behind our neighbours. Perhaps, however, such Cassandra warnings as to national progress or the want of it, are useless and vain, and that the march and destiny of nations is fixed, a part of the Cosmos, in the hand of the Great Master; that we cannot, although conscious of arrested progress, or even of advancing decadence, materially modify or avert it—in this respect it may be that "che sará sará."

In civil engineering, the great and resolute advance of the foreigners is quite as remarkable. There are two large models of bridges, (of both of which we hope to give some account in the *Exhibition Record*,) worthy of the most attentive study. One of them is that at Maintz, carrying a railway across the Rhine, on the Pauli system, with a total length of 3375 feet. The other, the noblest lattice structure probably in the world,—viz., the bridge at Dirschau, which connects the Russian and Prussian railway systems.

It requires not much examination of this latter, to be convinced how great an engineering blunder tubular bridges are—much cried up, as they have been, by partizans of the late Mr Robert Stephenson. Probably, one half the immense capital expended upon the Britannia and Victoria bridges, would have sufficed to have completed these respective railway communications, upon the plan of this bridge of Dirschau, and in every way as durably and sufficiently, for any useful purpose.

It is one of the most palpable characteristics of foreign engineering, as compared with ours, that they effect their ends very often, by simpler and more scientific means, and at less cost. Sound mathematical training, in which our elder school of engineers, now passing away, were so deficient, and in which the foreign engineer is so remarkably a-head of us—is no doubt in part the cause of this—in part it is also, that our capitalists are rich, often ignorant, and "bleed" more freely, than the poorer men of money on the Continent, who often insist upon having a reason, for large engineering expenses.

Reverting to the raw products, the relative backwardness of our own metallurgic display, is unquestionable due in a great degree to the fact that, whereas, on the Continent they have had their schools of mines, and of metallurgy, and their whole train of well organized art education, with travelling pupilships, to spy out, and learn, and report back at home, all that can be seen or taught by every nation abroad, here, in Great Britain, until within the last 15 or 20 years, we absolutely had no attempt at anything of the kind. A professor's chair of applied chemistry or of metallurgy was exotic or unknown; our manufacturers blundered on, by "trial and error," and husbanded jealously such experience as they had been able to hammer out. And even now with us in this respect, aye truly, in all that relates to education, of the middle and lower classes—that is, to all that belongs to usefully convertible education—to bread knowledge, we are lamentably in the rear of our Continental neighbours. With us "the harvest (of ignorance) truly is plenteous, but the labourers are few." Let us take, in all teachableness, lessons from the noble educational systems of Prussia, and even of France. Above all, let us guard against one of the grand obstructions to elementary education existing in all the three kingdoms of Great Britain; let us permit no church, nor sect, nor creed, practically to have the power to say—"Either you shall let your child learn my orthodoxy, or I will take care he shall have no means of learning anything—not even to read."

The metallurgy of the Exhibition is full of these suggestions—Krupp's giant steel, Deville's enormous block of liquified platina, the display of aluminium, in which at Newcastle we are about to follow out French lessons upon a great manufacturing scale, all have come of superior scientific education abroad.

A great task, one in which our power as a nation is more concerned, than those who look upon the surface only, may imagine, has devolved upon our Murchisons, and Percys, and Tyndalls, and Smythes. It is for British statesmen to see that the powers they exercise are adequate to the necessity, and that they are neither fettered nor restrained.

To the educated, but unprofessional man, the western annexé will afford may objects of the highest interest and excitement. He will see

Holme's machine for converting heat, first into mechanical power, and bringing this into contact with magnetism, evolving light from both—light blinding and empyreal as the sun's beams, and already employed to guide the seaman in his ocean track—

"A gem of changeful light
Bound on the dusky brow of night."

He will be pleased at once, and astonished, at the almost sentient adaptivity of some of the automatic machines. He will see a machine for making paper bags, and one for folding pamphlets, doing the complex work of human fingers, almost as though guided by human intelligence. And are they not so. Is not the human intelligence that once creates a machine *ever there* presiding over its movements as it were, like the unseen presence of a diviuity.

He will see a machine for folding up and sealing into paper, cakes of chocolate, invented and made, by the chocolate maker himself, whose movements, all derived from cam work, hidden within its casiug, are so complex, yet so exact, so consecutive and withal so deliberate, that the thing seems to fancy often, to be alive, and to the learned in such matters, brings back to memory, the great automaton achievements, of Vaucanson and Maillardet of the last century.

Perhaps most remarkable of all, he will see the American type-composiug, and afterwards type-distributing machines, exhibited by Spottiswood & Co.—one of the greatest triumphs of Kinematic ingenuity, that has ever been perfected. But this we really must reserve for a separate notice in the *Journal*. In the *Exhibition Record*, a full account of it will of course be given in the article on printing machinery.

These "rough notes" are far from exhausting even the popular wonders, of the west annexé alone; there are abundance of others; and even wonders of a like class are not confined to the annexé. So much is the fact the opposite, that now and then, even to one who has had his mental stomach properly trained before hand, and has his intellectual digestion in good order, the thought of something of a plethora of productions, of a hopeless redundancy of dishes, spread before the eye, now and then recurs, as after hours of incessant attention, he sinks exhausted, upon some bench looking out over the green sward of the Horticultural garden, and seeks creature comforts and repose.—Ed.

THE NEW MUSEUM ROOMS, SOUTH KENSINGTON.

On the 6th June, the two new halls, which form the commencement of a great chain of such apartments, that ultimately are to sweep away, and become substituted for the "Brompton boilers," were formally opened and inaugurated by the Commissioners, by a conversazione of more than common brilliancy even for London, at which more than four thousand persons were present. The opening of these two great halls is associated with another "exhibition" now arranged within them, and open to the public, which, were it not for the overtopping interest and vastness of the international collection so closely adjoining, would alone become food for comment and journalism for weeks to come.

Probably, at this moment, there does not exist in all the world beside, so grand—in very many particulars so wholly unique—and, in all, so beautiful a display of objects of fine art and manufacture, as is now to be easily seen within these halls. The having brought into existence this collection reflects great and well-deserved credit, upon those connected with the educational department of Government.

It is scarcely within our province, to enlarge upon the priceless gems of art production that have been placed here through the liberality of their various owners, at the request of the Commissioners. Many of these have claims to historic, as well as to artistic celebrity. We cannot pass, however, without some approving remarks, the two new halls themselves which form the great casket of these jewels. Both are, as yet, not complete, being only first portions of a future matured and entire work. They are from the designs of Captain Fowke, R E., and it is with real pleasure that we are enabled honestly to say that they appear to us—in fact, they seemed to be accepted by all—as highly creditable to his architectural taste and his constructive skill.

One of the two halls is Lombardic, and we consider it extremely handsome, and well suited to its purpose. The roof is semi-circular arched, with wrought iron plate and angle iron ribs, admitting abundant light, and harmonising excellently well with all that is below them.

This hall is crossed centrally between the two spans by an arcaded gallery carried also upon Lombard arches, and leading out upon the celebrated marble balcony of Sienna, placed in the second hall. The tiled floor of this gallery is very effective in design, and in execution perfect. The other hall, which is nearly square, with lateral smaller secondary apartments, is in a more subdued architectural style, and temporary screen walls scarcely, as yet, admit of its showing to full advantage. The roof consists of nine large rectangular, glass and iron cupolas, formed by and supported upon four large intersecting lattice girders, the constructional details of which present several features of novelty, the upright lights of the skylight cupolas being formed within the depth of the girders. The lighting by day appears to be excellent and well diffused. On the evening of the 6th, the illumination was very beautifully and perfectly produced by long ranges of gas jets below the roofing. The ventilation appears to be all that can be wished for; it was quite adequate to all this gas burning, and to the vast crowd of admirers collected upon the occasion.—En.

DESCRIPTION OF A NEW WEAPON, PROPOSED TO BE CALLED A "ROCKET RAM."

The purpose of this weapon is to approach an enemy's ship, or works of coast defence, in safety, to within a distance of from 10 to 20 yards, and to discharge against it, below the surface of the water, a bolt weighing 15 cwt. or more, with a velocity not exceeding 400 feet per second, which bolt or projectile will explode after it has struck, so as to produce an irreparable breach in the side of the vessel, from 3 to 6 feet below the water line. The accompanying engravings show the arrangements by which I propose to accomplish this end, and the details of it are sufficiently explained for the present purpose, I think, by the following explanation:—Fig. 1 is a longitudinal vertical section, broken away at the centre, and showing the fore and mid-ship portion of the vessel. Fig. 2 is a corresponding section of the after part, showing the arrangement of the engines and propeller. Fig. 3 is an enlarged longitudinal section of the gun and "rocket ram," or bolt; fig. 4 is a transverse section of the vessel; and fig. 5 is an enlarged sectional view of a portion of the details, showing the connection of the curved deck to the cross bearers.

The weapon consists of a vessel, 220 feet long, of exceedingly sharp lines, and drawing only from 8 to 9 feet of water, carrying an engine of 500 nominal horse power, which will enable it to attain a speed of from 15 to 16 knots per hour. This vessel is provided with a curved deck, composed of armour plates of 3½ in. thickness, firmly bolted to strong cross bearers, and breaking joints with each other, so as to constitute a continuous rigid structure. This iron deck is covered in the middle with 6 in., and towards the sides with 2 feet, of solid timber, forming a regular deck, intended chiefly to weaken the effect of the enemy's shot before striking the iron. Considering the lowness of the deck, this vessel could only be struck at a very sharp angle, and the shot would in all probability glance off without breaking the iron plates. The only projections upon the deck are three domes of 4½ in. iron, which are pierced all round, and serve the purposes of "hatchways," of "look-outs," and for defence in case the enemy should come on deck.

A large brass gun, of 8 in. internal diameter, and 16 feet length, is fixed rigidly into the bow of the vessel, about 4 feet below the water line. This gun is made breach-loading (as shown on the drawing), and is, moreover, capable of being closed at the muzzle by means of a sliding valve, which can easily be worked by means of rack and pinion from within the vessel.

I may here observe, however, that in case this valve should be broken, or otherwise disabled, the gun may be loaded, nevertheless, by introducing a wad into the part of the gun behind the wedge, and of pushing the same forward at the instant when the breach-loading wedges are removed. This wad is then followed up by the projectile and the charge, and the gun closed ready for firing.

The projectile consists of a cast-iron cylinder, containing two cavities, which communicate by means of a fuse-hole. The front cavity being filled with gunpowder, is closed in front by means of a steel head, which is tapered towards the front, and is terminated abruptly by a concave surface, producing a circular cutting edge to lay hold of the side of the enemy's ship in striking the same obliquely. The second cavity receives the charge after the projectile has been placed in the gun.

Considering the great weight of the projectile (15 cwt.), and the comparatively slow velocity it is intended to attain (400 feet), it is necessary that the charge should burn about three times slower than an ordinary charge of gunpowder, in order to produce the same pressure within the gun at every point. In order to insure this result, it is proposed to compress the powder into a metal casing, and to form in the same three conical cavities, in the manner of charging a rocket.

The rate of combustion will thus be limited, but will increase as the circumference of these cavities increases, tending to maintain a uniform pressure behind the projectile during the time of its accelerating flight. Supposing the pressure of the powder gas to be the same in this as it would be in an ordinary gun, it follows that the amount of force stored in the heavy projectile will be at least three times greater, because its

acceleration is three times slower, and the pressure is allowed to act upon it three times longer.

The gun is intended to be fired by the commander of the vessel, by means of a battery, and connecting wires. When the charge of compressed powder in the aftermost chamber is consumed, the fuse at the end of it will convey the fire to the foremost close chamber, which being filled with powder, will explode, say half a minute after the projectile has left the gun.

The reaction produced by the discharge of the gun causes a heavy suspended pendulum, shown in fig. 2, to jerk forward, which, being connected to the engine gear, causes the latter to be reversed, in order to prevent an entanglement with the enemy's ship.

Immediately after the discharge of the gun the slide at its mouth is closed, the breech is cleared, and the water contained in the gun having made its escape into the vessel, another projectile is introduced by the aid of a travelling crane, as shown. The charge of powder is next introduced, the wedge replaced, the touch-hole fuse adjusted, and the slide at the mouth of the gun withdrawn in order to make ready for a second firing. These operations need not occupy more than five minutes. In order to prevent the water from penetrating to the powder, the projectile is provided with one or two grooves for the introduction of cupped leather rings or other packing.

In order to prove the power and efficacy of this weapon, it is necessary to calculate the retardation of the projectile in passing through the water, also, the penetrating force of the blow in striking, and the amount of reaction that will be experienced in the vessel.

Assuming the weight of the projectile to be 1500 lbs.; the velocity with which it leaves the mouth of the gun=400 feet per second; the distance from the enemy's ship=60 feet; the weight of the vessel=1000 tons, we shall find that the force residing in the projectile on leaving the gun is = 1500

$$\frac{}{64} \; 400^2 = 3{,}750{,}000 \text{ ft. lbs.}$$

The resistance in the water of a cylindrical body of one square foot area, and moving with a velocity of 17 feet per second, is known to be about 50 lbs. The resistance offered to the motion of the projectile in question would be accordingly (its area being 1/3 square foot) $= 1/3 \cdot 50 \cdot (\frac{400}{17})^2 =$ 9204 lbs. Neglecting the decrease of resistance which would take place in consequence of a decreased velocity, but assuming 9204 lbs. resistance to act during the whole flight of 60 feet, the store of force communicated to the projectile will be diminished to the extent of $9204 \times 60 =$ 552,240 ft. lbs., and the projectile will strike with a force of—

$$3{,}750{,}000 - 552{,}240 = 3{,}197{,}760 \text{ ft. lbs.}$$

or with an actual velocity of 370 feet per second.

The crushing effect of this blow will equal that of an Armstrong or Whitworth bolt of 142 lb., striking the object with a velocity of 1200 feet. It may, therefore, be fairly assumed that no vessel afloat would resist the same. The armour plated vessels would have no advantage over ordinary men of-war, because their strong plating does not extend beyond two feet below the water line, whereas the proposed projectile would strike several feet below that line.

The amount of reaction that will be produced upon the vessel by the firing of the gun must be=

$$\sqrt{\frac{375{,}000 \text{ (force developed)}}{2{,}200{,}00 \text{ (weight of ship)}}} \; 64 = 10{\cdot}4 \text{ ft.}$$

that is to say, the velocity of the vessel will be checked to the amount of 10·4 feet per second, or the shock experienced on board will be equal to that of a railway train moving at the rate of 7 miles per hour being brought to a sudden stop. This amount of reaction will not, it is presumed, affect either the structure of the vessel and engines, nor the crew on board, injuriously. The case is certainly very different in a regular steam ram striking an enemy's ship with a velocity of 15 knots per hour, or 25 feet per second, where the effect of the shock will be greater in the proportion of $2\,5^2 : 10{\cdot}4 = 6 : 1$. Without presuming to an intimate knowledge of naval tactics, I may be allowed to suggest a few cases where I think the proposed Rocket Ram might be used with great effect.

1. It might be used in attacking an enemy's fleet lying at anchor. Its lowness of deck, and absence of rigging, would favour its approach to within 10 or 20 yards of the first ship, which would be fired into, causing it to sink or to be disabled, if the blow were aimed at the rudder or propeller. The attack may thereupon be directed against a second vessel, and so on in rapid succession. It might be desirable to fit the ram employed for such a service with two guns, one above the other, imbedded in the stem, in order to increase the rate of firing, and to be able to fall back upon the second gun if one should be disabled.

Fig. 1.

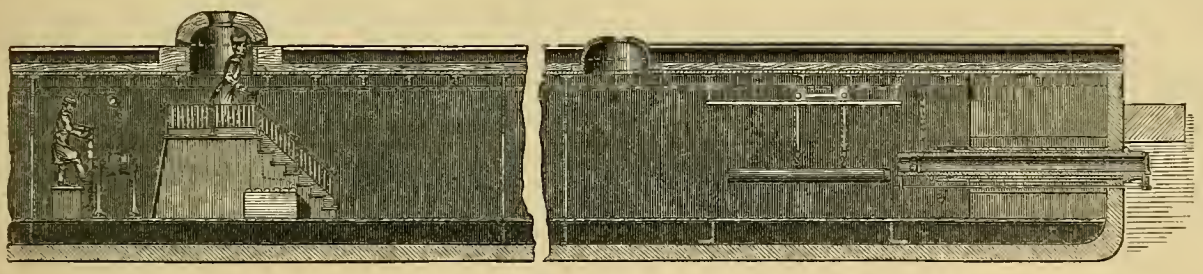


Fig. 2

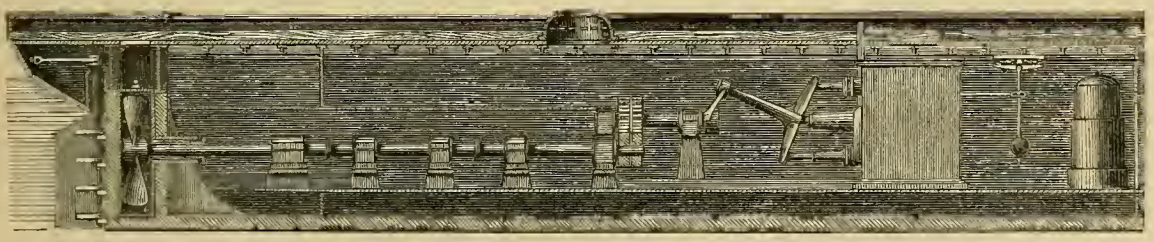
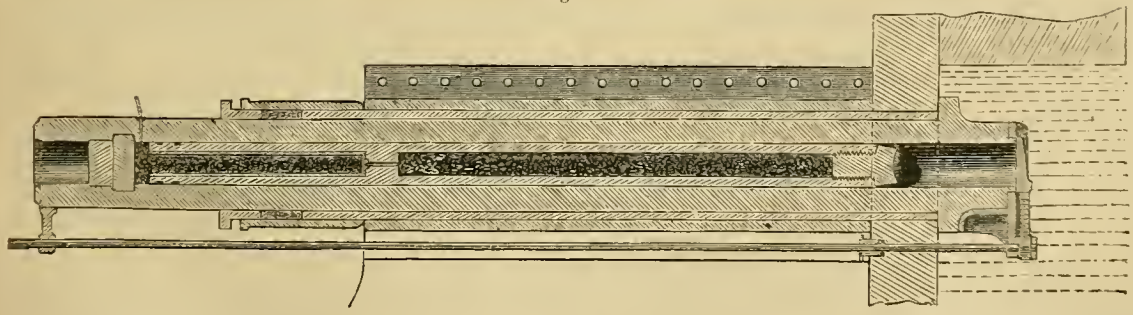


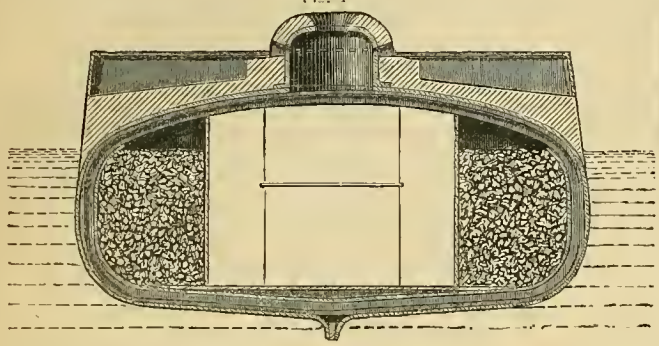
Fig. 3.



2. In meeting an enemy's vessel at sea, which, on perceiving its danger, should seek safety in flight, the great swiftness of the Ram will enable it to overtake the same, and having approached it within a distance of 20, or even 40 yards, its projectile could not fail to hit, provided only that the commander fires at a moment when the enemy's vessel covers his stem.

3. In meeting a hostile man-of-war at sea, the Rocket Ram ship

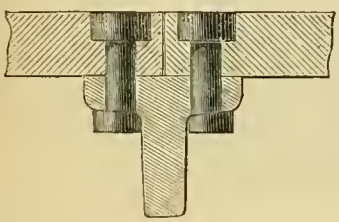
Fig. 4



would give it some 100 yards wide of berth, and on approaching, suddenly wear round, stopping the engines until its stem points directly towards the enemy, at a moderate distance from the same, when the discharge should take place.

4. The Rocket Ram might be used with great effect, I beg to submit, in destroying the enemy's land works, such as dock entrances and breakwaters.

Fig. 5.



The Rocket Ram ship should be kept as light as possible, consistent with the necessary engine-power and stores. Stores and fuel sufficient for 3 days' sailing would probably suffice under all circumstances. The engine should be powerful, but light of construction. The description of engine which would combine the qualities in the highest degree, would probably be a caloric engine of peculiar construction, which I have long been engaged in maturing. But if a steam engine be used, it should be worked with high pressure steam, to be produced in tubular boilers, and liquified by surface condensation, in order that the same water might be used again and again.

These, and other details, can safely be left for future consideration of experienced persons.

C. W. Siemens.

3 Great George Street,
Westminster, June, 1862.

In our part for April last, we published an account, with our own remarks, of Mr Thos. Page's patented method for discharging cannon through an under-water port-hole in a ship's side, at an enemy's ship—the object being to strike the latter below the level of any armour plating. In the foregoing, will be found Mr Siemens' account, in his own words, of a project having a like object, and which it appears he laid before the late Minister of War and the Admiralty, as long ago as June, 1861, and in November of that year, took the first steps to patent. Mr Siemens appears to have experienced the usual amount of official inertness or hostility—at least nothing has been done, after the lapse of a-year, with a view to the trial of his project; and although we have it from himself, that his own judgment remains unchanged as to its value, he has, under these circumstances, permitted his patent to lapse; and now, in communicating his invention to the world, secures at least the rights of priority as an inventor.

This is but a slender reward to any man of ability and position, but it is about the result that every one may expect who devotes mind and time to placing new projects before any of the war departments of our Government, as now constituted. Circumlocution, delay, and to the pertinacious, final "bowing out," are the common lot of nearly every first project, or of a new thing; but what is worst of all, the good things, although officially ignored, are generally remembered, and at some subsequent time they re-appear as "bran new" ideas, promulgated in some official document, or by some individual in connection with Government, and officially cognizant of the original communication. A remarkable example of this is noticed elsewhere, in our pages, for this month.

There are some points analogous in Mr Page's and Mr Siemens' projects; there is this rather important difference, however, that the former is impracticable, while the latter, whatever might ultimately be found to be its aggressive capabilities, sins against no law of nature, and could at least be safely tested, and applied in practice.

We look upon this class of inventions as more important than even they seemed previous to the recent engagement of the *Merrimac* and *Monitor*, i.e., previous to the *only*, and very small amount of experience we yet possess, of what ram ships can effect, against other armour plated vessels, and what they may suffer in the encounter.

It seems pretty clear, that if the advancing ram ship is to commence her career at a sufficient distance from her antagonist, to get up her full crushing speed, her intentions must be anticipated by her opponent, who can, if of moderate size and handiness, escape being victimised, by "dodging," so as to prevent any effectual blow being given her. This seems to have been the aim and manœuvre of the little *Monitor*, which kept running round the huge *Merrimac*, and always close to her, like a man running round a crocodile, or dog round a bull, so that the latter had no time to turn, and could neither aim nor shape a run at her, nor have one long enough to get up her speed.

Had the *Merrimac* been one of our *Warriors*, the result would not have been different, especially if the reports as to the steering qualities of the *Warrior* be founded on fact. They probably would have been widely different, if the *Merrimac* or a *Warrior*, had encountered another ship of her own large class, equally huge and fast, and equally unhandy with herself. In such a case, an effective blow might probably be secured by one or other of the ships upon its opponent; but such a blow has never yet been given, and it remains to be seen what will be its effects upon the striking ship, as well as upon that stricken, before the practically offensive powers of ram ships can be viewed as more than in the highest degree problematical. That the stricken ship may be very seriously, perhaps irreparably, damaged, is not a matter of doubt; but we have found nothing to assure us that, under such circumstances in her opponent, viz., equal mass and strength, great size and great speed, any ram ship shall find herself, after her first blow, in a state to give a second.

Nothing but actual trial can decide, what amount of derangement shall result to the ship, and all that is within and without her, by the sudden "bringing up" (assuming even a crash of twenty feet horizontally made into the smashed ship) from a speed of twelve to sixteen miles per hour. Everything in and upon the ship must be brought to rest from this great speed, within little more than a second of time; and when we hold in view that Mr Mallet has proved, that the actual velocity of earthquake shocks, which overthrow whole cities, and wrench asunder even great frames of carpentry, rarely exceeds ten or twelve feet per second, or about *half* the velocity of a fast ram ship, the greatest doubts are suggested, as to what derangements will be produced, by a shock which, taken under the most favourable dynamical conditions, must be twice as formidable to all on board the striking ship, as that of a great earthquake.

The dynamical conditions are precisely alike which produce dislocation, fracture, and overthrow by earthquake shock, and by the shock of the arrested motion and inertia of a ram ship. That the water in the boilers, thrown about in violent surges, forward and backward within the boilers, will produce a sudden rush of steam, with almost explosive violence, scarcely admits of doubt; and against this peculiar danger, of which we know the Admiralty authorities were warned a year or more ago, we believe no special precaution has been taken in the construction of the boilers of the *Warrior*, or of any of the other proposed ram ships. For these, and like reasons, we deem any practicable project important, that, like the present, aims at disabling armour-plated ships by other means than making the attacking ship one huge projectile, and throwing her bodily against her opponent—a thing in itself as old and barbarous as the Triremes of Salamis or Actium.

One conceivable mode of attack against the most vulnerable part of an armour ship is that of firing a bolt at a low velocity, through the water, as now proposed. It seems sufficiently feasible at least to deserve a complete and impartial trial, under the inventor's directions. Mr Siemens, by substituting a very heavy bolt and shell combined, slowly put into motion, and driven forth from his long gun, by a sort of rocket charge with a very moderate velocity, has got rid of the main objection to attempting the fire of projectiles through the water, viz., the tremendous jar upon the projecting ship that must result from a high initial velocity.

It would seem highly probable that even at a much lower velocity than 370 feet per second, a bolt of 15 cwt. must, in smooth water at least, easily pierce through the bull of the stoutest iron-built ship below the level of armour-plating. Some doubts, however, rather for inquiry than in the shape of objections to the plan, suggest themselves to us.

Suppose the ships at sea—and in no more "sea-way" than is usually found in a stiff breeze even in our channel seas—the water is in wave movement down to at least ten feet in depth; what perturbations will be produced in the short traject of the immersed bolt, by its becoming for

the moment part of the undulatory stratum? May it not be quite sufficient often to make the blow against the enemy's hull so oblique, that the bolt shall turn over rather than penetrate.

Even, in such a case, if means were provided that the shell part of the bolt should explode, the moment the latter turned over and lay broadside on to the hull, we believe the explosion of a moderate charge would rupture and bilge in the side of the strongest iron ship.

Mr Siemens proposes to fix the long gun *rigidly* to the bow of his ship; we should deem it more advisable to place, as effective and large as possible, an india rubber buffer between the collar at the muzzle of the gun and the frame of the ship. Admitting, *argumenti gratia*, Mr Siemens' calculation, that the effect of the recoil will be a retardation of only 10·4 feet per second upon the speed of the ship, still, the force producing this must be impressed upon the ship within the time that the bolt passes through the chase of the gun; that is, upon his data, within less than one-twelfth of a second.

A push administered so brusquely as this to a ship would not be transmitted with perfect uniformity to all parts of her frame, it would be partially of the nature of a blow given at the place of the gun, and we should fear (with the arrangements proposed) more or less injury by the discharge. The actually measured initial velocity of Mr Mallet's 36 inch shells did not greatly exceed 500 feet per second, yet the recoil of the mortar and bed (together weighing about fifty-two tons) was a formidable push, enough to cause the whole mass to run sixteen or eighteen inches up an inclined platform of considerable angle, and was by no means equally transmitted from the mortar itself to all parts of the bed, and thence to the platform.

We are not at all certain that any rocket burning composition, could be made that should communicate, within sixteen feet of chase, a velocity of 400 feet per second of the fifteen cwt. bolt.

A rocket does not "get up steam" all at once, nor until the whole surface of the bored out cone in the interior is in ignition and developing gas, so that part of the sixteen feet of chase would be passed through with a very low velocity, and probably the final velocity fall much below 400 feet per second. When rocket "composition" is made to burn *extremely* fast, it is extremely liable to produce accident; when fired, the rocket explodes, in place of burning more slowly; the consequences of such an accident would be serious in this case, involving the bursting of the gun, in a confined and vital part of the ship. Now that the making of large-grained powder (powder, indeed, no longer but lumps as big as nuts) has become a manufacture, probably slow burning charges might be devised, separated by a number of diaphragms of metal, each pierced with a small hole to convey fire to the next charge beyond, etc., that should avoid this danger; and the gun itself might, no doubt, be so arranged and enclosed, that its bursting would be less formidable to the ship and crew.

Nor are we prepared quite to agree with Mr Siemens' figures, as to the retardation of velocity in the bolt produced by the water.

No increase of velocity could be counted upon, after the bolt should have left the chase of the gun, albeit that it would still be an ignited rocket passing through the water. In air, the rocket moves by the unbalanced pressure of the issuing gases remaining almost unchanged, immediately in rear of it, owing to the small capacity for heat of the air through which it flies, and hence its small cooling effect upon the hot gaseous stream. In water, however, the effect would be very different, and the propulsive effect, probably, very small comparatively. But, again, we believe Mr Siemens has rather under-estimated the resistance due to the water. The bolt, like all other bodies moving immersed in a fluid, would carry with itself a body of enveloping water. The sectional area of resistance, therefore, must be measured not merely by that of the transverse section of the bolt—the efficient area of resistance would probably be at least twice as much.

In calculating the reaction upon the ship of the bolt propelled as assumed, it appears to us that the author neglects two elements both important in considering the effects of the sudden push upon the ship. The bolt cannot be viewed as resisting the propulsive force merely by its inertia; the inertia of a large mass of water in front, as well as its resistances of viscidity, friction, etc., must be taken into account on the one hand, and the fluid resistances in the way of stern pressure opposed to the ship's retardation upon the other; these induce us to think that the force visited upon the frame of the ship close about the point of attachment of the gun might, in any case, prove very formidable. We, however, fully agree with the author that the chance of damage to the ship would be a great deal less than must result from throwing her as a ram bodily against an equal enemy, at fifteen or sixteen miles per hour.

We have brought forward all the gravest difficulties or objections that appear to us can be validly advanced against Mr Siemens' plan. None are of such a character as would warrant a conclusively unfavourable verdict against his plan. Why should it not be tried? The trial need cost but little, and the information gained in an unknown region, even should nothing better result, would well repay it. It would be good national economy to be able to stop building armour-plated ships at the earliest moment. We shall never be able to do so before some method has been devised, tried, and found effective, by which they are made as vulnerable, as the old wooden ships are to our present methods of attack. The obvious mode of attempting this is clearly by directing the attack against their most vulnerable and least reparable parts—their hulls under water.

Two conceivable plans at least for such attack have now, within a few weeks, been first published in this journal—the present, and that by marine floating shells of Captain Harvey, R.N.

A third project we ourselves know to have been presented to the Admiralty, about two years ago, based upon the explosion of external shells against the hulls of armour plated ships. Can it be possible that none of these (and doubtless other like projects are also before that department) will be tried until some hostile power shall have first tried some such thing upon one of our own armour ships, and wakened our official apathy or tardiness by sending her to the bottom.—Ed.

HYDRAULIC GUN MOUNTING.

THE REPORT OF THE COMMISSIONERS ON NATIONAL DEFENCES ON THE SPITHEAD FORTS.

Those who have (amongst our readers) followed the successive articles in our parts from January to April last, upon the subject of "Hydraulic Gun Mounting," as proposed to Government as far back as 1856, by Mr Mallet, will have become acquainted with the fact, that that gentleman's propositions on the subject of improved gun mounting, although backed by the approval as to principle, of Sir John F. Burgoyne, Inspector-General of Fortifications, and sent forward by that distinguished officer, with a request that they might be "impartially reported upon," were in fact quashed, by the unfavourable report of the Ordnance Select Committee of Woolwich.

The Report itself, together with Mr Mallet's remarks, and the grounds upon which he considers that it is neither impartial, nor just, nor wise, may be found in our part for April last. In the 17th and following clauses of the report, to the end, it will be observed that the aim and express tendency of the opinion of the Ordnance Select Committee, is to disapprove of hydraulic gun mounting in any way or form; and generally, to discountenance any proposal, for working artillery by mechanical means—"nothing like a common four feet handspike," is the dictum of the Committee at the end of the year 1859, to whom "*it does not appear that hydraulic power can at present be introduced with advantage for the purpose proposed.*"

In direct contradiction to this, the collective and deliberate opinion of the Select Committee, we find the following given, as the equally deliberate result, of the investigation of this particular point, by the National Defence Commissioners, (just published) upon the Spithead Forts, and a copy of which, any of our readers may see in the *Times* of the 29th May last.

In the 19th clause, the Commissioners express themselves as follows:—

"In consequence of the increased power of the guns that will be brought into use, their number may be considerably reduced, without impairing the efficiency of the forts, and *by applying hydraulic machinery to the working of these guns, great facility will be obtained for aiming at, and following a ship in motion; at the same time, that a much smaller number of men will be required, to work each piece of ordnance.*"

So then the Defence Commission, not only contradicts the Ordnance Select Committee, point blank, upon this point, but sustains its contradiction by adducing arguments almost in the very words in which Mr Mallet advocated his propositions when laying them before Government, and that same Committee. See p. 282 of part, *Prac. Mech. Jour.*, for February last, where Mr Mallet says, "*The angular movement of the gun may be so rapid, that a boat or ship in the most rapid motion may be kept covered, and the gun even discharged as it moves, if necessary.*" And again, p. 283, where he has summed up the points of advantage of the system proposed by him, and expressed all and more, than the Defence Commission as above quoted, in remarkably similar language.

It is almost amusing to find that amongst the distinguished names attached to this report of the Defence Commissioners, is that of Colonel J. H. George, R. A., the existing President of the Ordnance Select Committee.

The Select Committee could not, or would not, discern any thing beyond "the largest and heaviest guns at present in the service, the 68 pounder of 112 cwt., and the 10 inch gun of 87 cwt"—(see report, clause 17, p. 3, *Prac. Mech. Jour.*, April, 1862). They had no future, no foresight for 12 ton and 22 ton guns, although they had had the unmanageable (because ill mounted) 25 ton Mersey Company's gun already before them.

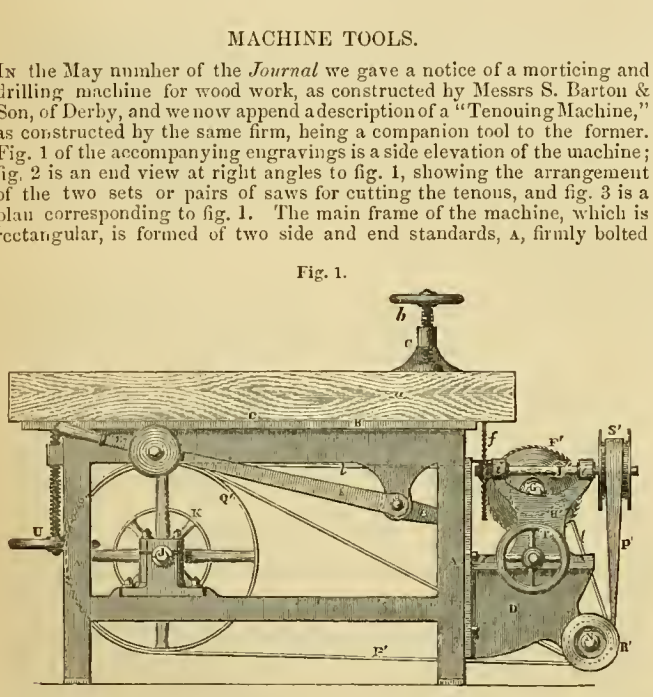
Mr Mallet foresaw these 12 and 25 ton guns, and told the Committee, *that guns must get to a size and weight that they could not handle, unless by hydraulic or some other mechanical power.*

Within less than three years, this has come to be the fact—a 12 ton gun of Sir William Armstrong's is already at Shoeburyness. A *hundred* artillery men find it a work of tedious labour and difficulty, with powerful "side tackles" to train this gun as now mounted there, and before an enemy, would probably not succeed in fixing six rounds in an hour from it. Sir William Armstrong is stated in the Defence Commissioners' Report, to be engaged in constructing another gun of 22 tons in weight. How is it to be worked? Will "the common four feet handspike aided by side tackles," be still found the orthodox and only proper thing, or will not Sir William Armstrong rather adapt to his large gun, the very hydraulic mounting that Mr Mallet appears to have been the very first to propose to employ, as a means for working guns, at least, in a substantive form, with detailed drawings, &c.? Sir William has long been familiar with the applications of hydraulic power to other purposes, having most successfully carried out into practice, the inventions in this respect made and matured by the late Mr Bramah; and, nothing is more proper than that he (Sir William) should apply this, the most suitable motive power to his great artillery; but, will justice then be done to the original deviser and promulgator of the plan, or invention, who laid it *freely* before Government, with no request but to have an impartial report. The facts since disclosed, suffice to show whether it was impartial and wise, or the contrary, and they foreibly indicate what sort of justice (to say nothing, of that rather maudlin word "encouragement") inventors might expect, were they deprived of the protection of the Patent Laws. Had Mr Mallet patented his plans, in place of laying them freely before Government, he would before long, if not now, be in a position to afford to the objectors to the existence of patents, "a great moral example" of the obstructiveness that they deem so injurious and impolitic. But in which case would the less injustice have been done? In which case would "*suum cuique*" have been best affirmed and secured?—Ed.

MACHINE TOOLS.

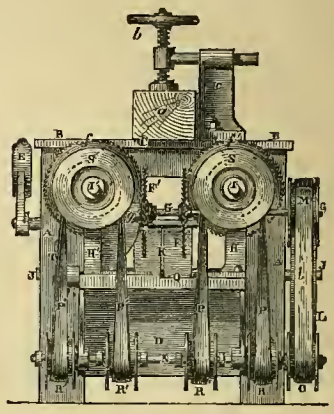
In the May number of the *Journal* we gave a notice of a morticing and drilling machine for wood work, as constructed by Messrs S. Barton & Son, of Derby, and we now append a description of a "Tenouing Machine," as constructed by the same firm, being a companion tool to the former. Fig. 1 of the accompanying engravings is a side elevation of the machine; fig. 2 is an end view at right angles to fig. 1, showing the arrangement of the two sets or pairs of saws for cutting the tenons, and fig. 3 is a plan corresponding to fig. 1. The main frame of the machine, which is rectangular, is formed of two side and end standards, A, firmly bolted

Fig. 1.



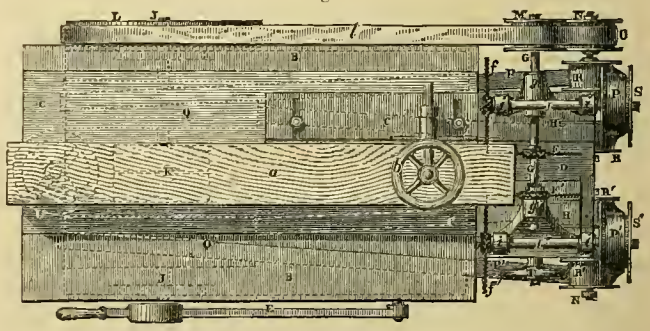
together, and supporting a flat planed bed plate, B. The central part, C, of this plate is moveable and attached by a hinge joint to one end of the frame, for the purpose of being raised when cutting angular work. At one end of the machine is arranged the sliding frame or bracket, D, working in vertical guides, and which carries the several spindles with their saws for cutting the tenons in the beam of wood as shown at *a*, mounted on the moveable port, C, of the bed plate. This frame, D, with its saws, &c., is actuated and counterbalanced by the weighted hand lever, E, keyed to a short transverse shaft, in the centre of which is keyed the short lever or wiper, *e*, connected by a link direct to the frame, D. This machine is arranged for the heavier class of work in which only one large tenon is formed or left at the end of the beam of wood, so that in this instance two circular saws only are required for "ripping" or thicknessing the tenon, and two for "cross-cutting" the side wood away or forming the "end shoulder" of the tenon. The two thicknessing saws, F, F¹, are mounted on one transverse spindle, G, running in bearings, *g*, formed in small brackets or pillow blocks, H, H¹, secured to the top of the sliding frame, D, while the two cross-cutting saws, *f*, *f*¹, are mounted on two longitudinal spindles, I, I¹, respectively, and running in the bearings, *i*, of the brackets, H, H¹, before referred to. The first motion shaft, J, of the machine is arranged to work transversely at the end furthest from the saw frame, D, in pillow block journals, supported by the lower rail of the two side standards, A. It derives its motion through the fast and loose pulleys, K, by a belt from any prime mover, and transmits it through the open belt, *l*, from the pulley, L, to the small pulley, M, on the outer end of the spindle, G, thus giving motion to the two saws, F and F¹. A light transverse shaft, N, carrying the guide pulleys for the several belts for driving the saws is mounted in bearings formed in brackets, pendent from the under side of the sliding frame, D, so that as all move together there is little or no alteration in the length of the belts, in whatever position the saw frame is in. The belt, *l*, for driving the saw spindle, G, passes beneath the guide pulley, O, on the outer end of the shaft, N, while the belts, P and P¹, pass from their respective driving pulleys, Q and Q¹, on the first motion shaft,

Fig. 2.



J, underneath the four guide pulleys, R, R¹, and upwards round the top of the two small pulleys, S and S¹, of their respective spindles, I and I¹, thus giving motion to the two cross-cut saws, *f* and *f*¹, which form the shoulders of the tenon. To tenon a piece of wood, *a*, it is laid upon the table, C, and against the face of the moveable fence, *c*, which are both set so that the off side of the tenon will be in a true plane with the fixed saw, F, and its shoulder in a line or plane with the saw, *f*, the fence, *c*, is then firmly screwed to the table or bed plate, C, and the vertical clump screw tightened down upon the piece of wood, by turning the hand wheel, *b*, it is now ready for tenoning. The bracket, H¹, which carries the two saws, F¹, and *f*¹, for forming the near side and shoulder of the teuon is fitted to the top of the saw frame, D, by a transverse screw and slide arrangement, so that by turning the hand wheel, T, the saw, F¹, which is mounted on a small hollow boss working in the bearing, *g*¹, and fitted to its spindle, G, by a groove and feather, is moved to and fro, so as to suit any required thickness of tenon. This being done and the saws all set for the particular size of work required, the attendant gradually depresses the hand lever, E, when the saw frame, D, is raised until the four saws have cut through the wood and carried away the two

Fig. 3.



rectangular pieces at the corners, leaving the clear parallel tenon. It will be observed by looking at the side and end views, figs. 1 and 2, that the spindles, I, I¹, of the cross-cut saws, *f*, *f*¹, are on a rather higher level than the spindle, O, of the ripping or thicknessing saws, F, F¹, so that the vertical tangential line at the periphery of each pair of saws, by this means coincides with or forms the exact right angle at the root of the tenon without the teeth of the saws touching each other so as to blunt them. When horizontal angular work is required, the moveable fence plate, *c*, is fixed at the required angle, and when vertical angular work is necessary, the end of the bed plate, C, furthest from the saw frame, D, is raised by turning the hand wheel of the screw, U, arranged for that purpose.

We may also notice another most useful tool recently designed by the same firm, which they term a "Universal Portable Drilling Machine," and is more particularly applicable for millwrights' and engineers' works

for drilling iron. Fig. 4 is a perspective view of this portable boring machine.

This machine is designed in one respect as a most complete bench drill, which, from the drill spindle being made to fix and work at any angle to the sole plate, it does away with much trouble and inaccuracy when a hole is required to be drilled in an article at an angle to that part lying on the lathe or machine.

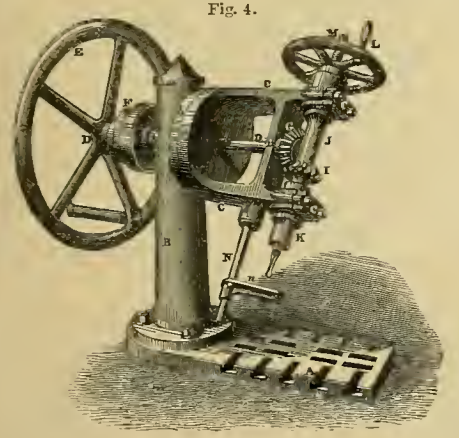
But its chief and most novel use to the engineer is as a yard or portable drill, for operating upon castings, either too large or of such a shape as to render it impossible (or at least at a great loss of time) to get them under a fixed drilling machine. For instance, it can be fixed upon the ground at the side of a large casting, the drill being turned round to the right direction, and a true hole made in the casting. Or the bed of the tool (which is planed top and bottom) can be fixed upon the work or casting, and the pillar carrying the drill head being free to turn on its axis, a great range of holes may be drilled without altering or refixing the machine, all true to each other.

In fact, its extensive use in large engineering works, and as a bench drill for small workshops, will at once be seen by the practical mechanic.

The following is a description of the various parts :—A, is the sole plate forming the bed upon which the vertical pillar, B, is bolted by means of four T headed bolts which work in a corresponding groove in the bed plate. The pillar, B, has also a centre peg or pivot, fitting into the sole plate, so that when the T headed bolts are loosened the pillar is free to turn on the centre pivot, and can then be fastened in any desired position.

C is the drill head or frame, which is free to turn on a centre pin or pivot, fitted into a correspouding hole bored in the face of the flange, *b*, of the pillar, B, a V groove is cut in the face of the drill head into which four bolts are fitted which is passed through the flange, *b*, of the pillar, B, and bolt the drill head thereto. The V headed bolt being free to slide in the groove; the drill head can be turned on the centre pivot to any desired angle, and fastened by the bolts again. An index is marked upon the flange, *b*, of the pillar to facilitate the setting of angles. The driving shaft, D, carrying the fly-wheel, E, cone pulley, F, and the bevel wheel, G, passes through the centre pivot of the drill head and through the bearing, H, in such a manner that the turning round of the drill head does not alter the relative position of this shaft, D, with that of the socket shaft, J, carrying the other bevel wheel, I. Thus as the socket spindle, J, is carried in the bearings, *c*, of the frame, C, which are at right angles to and passing through or across the axial line of the driving shaft, D, round which the frame, C, turns, it follows that in whatever position the frame may be fixed, the bevel wheels, G and I, will always be in proper gear and transmit motion to the hollow spindle, J. The boring spindle, K, passes through the hollow spindle, J, with a groove and feather attachment, so that while they both revolve together, it can be moved to and fro by turning the hand feed wheel, L, which has a brass nut keyed to its boss working into the screw, M, attached to the top end of the spindle, K. A strong rod, N, is cottered to a boss or socket cast in the frame, C, having a small rest plate or steading arm, *n*, projecting laterally from it, and capable of being fixed at any distance from the drill by a pinching screw. This stay or rest is particularly useful for some kinds of work, such as boring holes in small articles, or in the flanges of pipes, &c., but can be easily taken away when not required. The principal advantages of this drilling machine is that of its being so portable and capable of application to objects and in localities where only the hand brace or ratchet drill could hitherto be used, and of being set to bore at any angle, while it can either be driven by power through a belt from any prime mover in the vicinity, passed over the cone pulley, F, or by hand, through the winch handle of the fly-wheel, E.

Fig. 4.



THE NEW WESTMINSTER BRIDGE.

This job, begun before the Crimean war, at last begins to show decisive proofs that it is drawing to a close. It has been a long time in hand, but promises to be one of the most creditable works amongst the many bridges that now span the Thames.

The first delays were produced by the failure of the original contractor. The next were due to what was (if report speaks truly) a not creditable attempt on the part of other eminent members of the profession to wrest the work out of Mr Page's hands, by the help of a parliamentary inquiry; other delays arose then, through difficulties inherent in the work itself, and only overcome at a late period, so that it was not till about the middle of 1859 that Mr Page was enabled to set about the work with the vigour he desired. Since that time progress has been quick and steady, though, as the different portions of the structure advanced, they involved engineering operations of the most difficult and even hazardous nature. It was necessary in every case to disturb the old piers, though always dangerous and crumbling to decay—sometimes even to cut them in half under water, and shore up the remainder as well as could be effected till some pier for the western half of the new structure was placed. No cofferdams were used, and the manner in which the employment of these most expensive auxiliaries was avoided may be told in a few words. On the site of the pier, elm piles were driven deep below the bed of the river into the Loudon clay. Round these again were forced iron circular piles, grooved at the edges, so as to admit of sheets of cast iron being slid down like shutters between them. When these had been fixed and closed by divers, the space they shut in was carefully dredged out of mud down to the bed of the river, the piles tied together with iron rods, and the space filled in between with concrete up to low-water mark, when the masonry—enormous slabs of granite, weighing from eight to twelve tons—was fixed for the bases of the piers, and on these were raised the massive stone piers themselves. The arches of the bridge are seven in number, each formed of seven ribs, which are of cast iron nearly up to the crown, where, to avoid danger from the concussion of heavy loads, they are of wrought iron. The arches vary in span from the smallest, of 96ft., to the largest in the centre, of 120 ft, and from a height above high-water level of from 16ft. to 20ft. The materials used in the construction of the whole bridge have been 4,200 tons of cast and 1,400 tons of wrought iron, 30,000 cubic yards of concrete, 21,000 cubic yards of brickwork set in Portland cement, 165,000 cubic feet of granite, and 46,000 cubic feet of timber. Its roadway is 12ft. lower than the old bridge, and its total width more than double, so that while it lays claim to being the handsomest bridge over the Thames, it is also, size for size, by far the cheapest that has yet been built, costing per superficial foot less than half the price of any similiar structure in London. The length, breadth, and cost of each of the metropolitan bridges have been as follows :—

	Length. Feet.	Breadth. Ft. in.	Cost per Square ft.
London	904	53 6	£11 6 0
Southwark	800	42 6	11 5 10
Blackfriars	994	42 0	3 15 6
Waterloo	1,380	41 6	10 0 0
Hungerford	1,536	13 4	4 16 6
Westminster, old	1,100	43 0	7 16 0
Westminster, new	990	85 0	4 0 0
Vauxhall	840	36 2	9 16 0
Chelsea	922	40 0	2 5 0
Proposed new bridge at Blackfriars	980	76 0	3 5 0

Thus it will be seen that the new bridge is very nearly twice as wide as any of the bridges over the Thames. Within the parapets it is 84ft. 2in. Of this the footways occupy 28ft., the roads for the light traffic 39ft., the two tramways 14ft. 8in., and the space between them 2ft. 6in. The tramways consist of iron plates, bolted to timbers, and laid upon an elastic bed of cork and bitumen. The curb of the footway is formed of Ross of Mull granite; the footway itself is of Blashfield's terra cotta. It inclines towards the parapet with a fall of 1½ inch, and a gutter on each side carries off the water. The value of this material for paving purposes, may be estimated by the fact that when rubbed with sand and water against Yorkshire stone the stone loses twice as much as the terra cotta. This pavement is laid in diamond-shaped tiles, which are grooved across transversely, so as to give the firmest foothold. All these are in their way trifling improvements, but in the aggregate they are much. The combination of wrought and cast iron in the arches at first drew forth some comment from engineers; but the practical results have shown that Mr Page was right. When only the first half of the bridge was opened Bray's traction engines passed over it with weights which, taking into account the weight of the traction engine itself, were more than the arches were tested for. Yet all bore this severe and quite unexpected ordeal, with the slightest possible deflection and with scarcely any vibration worth speaking of.

The whole surface of the roadway has been formed of Mr Mallet's patent buckled plates—a form of bridge flooring now become very widely employed, but which Mr Page, with that courage in originality, which is one of his best characteristics, was one of the very earliest engineers

to adopt upon so great a scale. Each buckled plate of wrought iron is about 8ft. by 3½, and although only one *quarter of an inch* thick, every plate in the bridge has been tested by lowering upon the crown of the single plate a block of granite of the enormous weight of *seventeen tons*.

In any other form whatever, the same amount of transverse resistance, has never been got out of 280 lbs. weight of iron.

The slight hollows between the domes of the buckled plates, have been filled in by Mr Page with blocks of hard wood (old ship oak chiefly), sawn to form, and embedded in asphalte. Mr Mallet was anxious that pumice stone should have been employed for that purpose, from its extreme lightness, great power of resisting crushing, and absolute durability. Some difficulties were expected in obtaining a supply of the material, however, and wood, though not so durable, was decided upon by Mr Page.

Pumice stone, which is used to a great extent in Southern Italy, Sicily and Greece, for the purpose of constructing light and durable vaulting or domes and groins in ceilings, roofs, &c., and for filling in the haunches of such work, has never almost, been employed in Great Britain.

Its qualities are so valuable and so peculiar, that we feel satisfied it only needs some merchant, with enough of enterprise to speculate in a few cargoes, and to bring it before our large builders, to open quite a new trade of import.

Pumice may be had in Sicily, in the Greek Archipelago, or from Iceland, in any quantity, and would be by no means costly, if proper arrangements were made, for its coming in as back freight, or as ballast.

It is largely used abroad, as a valuable material for stove lining, and other fire works, for which its bad conducting power for heat, makes it available.

The eye of the really practical engineer will find much in the detail of the new Westminster Bridge worthy of note and praise.

There are few structural details better about it, than the way in which Mr Page has laid the foundations for his tramways,—that which has been just displaced (to make way for the permanent one) after having been exposed for months to extremely severe traffic did not exhibit the slightest looseness of the tram plates, nor derangement of any other sort.

Very different this, from the result of the costly tramways laid down throughout Woolwich arsenal, some three or four years ago, and all of which have since been obliged to be taken up, as the tram plates could not be kept steady in their places, for a week together. There are few more difficult problems to solve practically and well, than to construct a permanent tramway, for miscellaneous traffic. We may perhaps at a future time give a systematic account of this structure, but we hope that Mr Page himself, will publish a full account of his work, and of the peculiar methods of operation performed beneath the opaque waters of the Thames, of the ingenuity of which, few beyond Mr Page and his staff, and his able contractors Messrs Cochrane & Co., have any distinct notion as yet. Externally the elevation of the bridge, after all that has been said about "engineer's gothic" looks well, and proves the good taste and architectural leanings of its designer. We only hope that he will not in any wise mar his own work, by painting the iron work, the odious green tea colour that appears to be in contemplation, and which has so spoiled the appearance of his other large work, Chelsea Bridge. —En.

DOCK YARD MOORING BERTHS.

A PLAN has been submitted to the Admiralty, by Commander Noddall, Master-Attendant of the Royal Clarence Victualling-yard at Weevil, near Gosport, for utilizing the space available in Portsmouth harbour, in the immediate vicinity of the dockyard, for berthing Her Majesty's ships afloat. Under the present system, each ship swings at her moorings with the tide. The consequence is that a large amount of mooring ground can afford accommodation for but few ships. All must wait until wind and tide allow the swinging craft to lie fairly up and down the harbour.

Commander Noddall proposes to supersede the present swinging moorings with a line of pontoons each 30 ft. in length, moored head and stern at a distance of 500ft. from the dockyard, each pontoon being connected by bridges, on a simple plan similar to that carried out between the gunnery instruction ships *Excellent* and *Illustrious*, which lie moored by head and stern chains, off the north side of the dockyard. Taking six pontoons to form the line, it would give, allowing for the intervals of space between each, a total length, of floating double mooring jetties of 2,000ft. The connection between this double line of floating jetties and the dockyard would be formed in the centre of the line by a pontoon bridge opening in the middle. This pontoon bridge, which could be formed of the now useless iron mortar boats lying at Haslar, would give the means of communication between ships moored at the floating jetties and in the dockyard. The 500ft. space between the floating jetties and the dockyard would allow ample space for docking and undocking the Warrior, and other ships of her class. This space it is also proposed to consider as part of the dockyard, and to preserve for purposes only connected with the dockyard. The breadth of the harbour, measuring at spring tides, low water, is from the mudbank at Borough Island to the ship basin, 1,395 feet; from the King's-stairs to the mudbank south of Weevil-creek, 1,440 feet; and from the south corner of the dockyard-wall to the opposite mudland, 2,700 feet. Within this line of soundings it is proposd that the line of pontoons shall be moored.

Commander Noddall, we believe, has suggested that if pontoons should be thought too expensive, there are plenty of useless ships lying in Portsmouth harbour, or its creeks above the dockyard, which could be converted into a pontoon jetty, or mooring ship. Their conversion to so useful a purpose would effect the saving of a considerable sum yearly which they now cost in repairs and wages, and for provisions for a regular staff to take charge of them. To keep in repair the machinery of eight paddlewheel steamers now lying in the upper part of Portsmouth harbour, consisting of the *Furious*, the *Fury*, the *Inflexible*, the *Penelope*, the *Retribution*, the *Sampson*, and the *Vulture*, a few years longer on hand, will involve an expense alone greater in amount than the price their machinery and their hulls broken up would bring if sold. An application of Commander Noddall's plan to the deep-water berthing space of the upper part of the harbour of Portsmouth, in addition to floating jetties, would add immensely to the berthing accommodation of the harbour, and, in fact, convert the whole harbour into one vast steam basin. The jetty accommodation of Portsmouth Dockyard gives room for only three ships of ordinary size, or for two such as the *Warrior* or *Black Prince*. These jetties would still remain available in the event of the floating jetties being formed, while the latter would give additional accommodation for 12 ships of the largest class.

This proposition appears to us to open up a highly important subject, and one suggestive of the vast extension of applications to which floating platforms, carried upon pontoons analogous to those forming the landing stages at Liverpool, and at Birkenhead, may be hereafter adapted in connection with our harbours, and especially with our great naval and military centres.

One of the great results that has been achieved at Cherbourg, by the excavation of millions of tons of solid granite, and the construction of thousands of yards of solid quay, has been the power, of placing a whole fleet of transports or ships of war alongside these, and embarking troops, or even cavalry and artillery by their simply marching on board. All this power may be obtained at less than a tithe of the cost, and in infinitely less time expended in construction—in almost any of our great naval and military harbours or roadsteads—by the formation of floating platforms, moored in place, presenting abundant surface, covered in part, if desirable, and placed in connection with the shore by similar floating roadways. The adoption of Commander Noddall's plans at Portsmouth, provided his lines of mooring pontoons were not formed of mere cut down old ships or hulks, but of great rectangular and connected flat pontoons, having a breadth of not less than 80ft., would give to our great naval harbours all the offensive powers of Cherbourg, for the embarkation or disembarkation of troops.

The saving of room in the harbour, which is the proposer's primary object, is obvious; but numerous other advantages suggest themselves in favour of such an arrangement as shall enable all ships in the harbour, to lay permanently alongside, such floating platforms. All their stores can be shifted or brought on board with an infinite saving of time and expense as compared with existing practice. These mooring platforms would become great exercising decks at all times for the crews. Rifle practice at long ranges, might be conducted regularly upon them, and they might become places of liberty and recreation occasionally, for the men, without the temptations that surround their going on shore.

We are strongly persuaded also, that great lines of such floating platforms, upon pontoons properly constructed to be unsinkable, although much perforated by shot, or by vertical fire, would form the most effective and impregnable of booms, for the defence of such places as Spithead, and upon them gun batterys might be prepared and worked with every advantage of position. Their construction might readily be such that the guns could be in a few seconds run into the water and sunk, if found necessary to be abandoned. Properly constructed, and with an advanced horizontal fender of perhaps 30 feet wide of wrought iron lattice work, to receive the first crash, and buff the blow by being itself broken—no ship in the world could be able to break or penetrate such a pontoon boom. The whole advanced side of such a pontoon boom, too, might be hung with armour plates at exposed places. The only method of destruction of such a defence would be, the driving down upon it, a fire ship with a prodigious charge of powder, and getting her exploded close along side.—En.

Second Series

Plate 289. # BYEPASS VALVES AND GOVERNOR FOR GAS WORKS, Vol. VII.

BY Mr GEORGE BOWER, GAS ENGINEER,

ST NEOTS, HUNTINGDONSHIRE.

Fig.1.

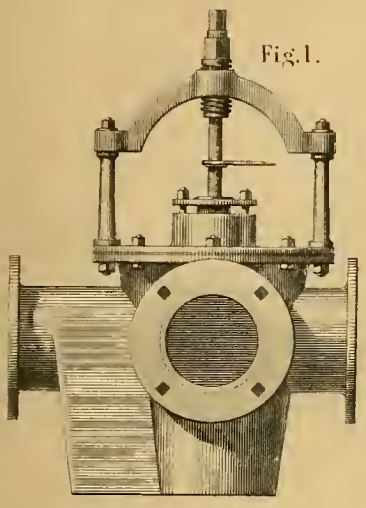


Fig.2.

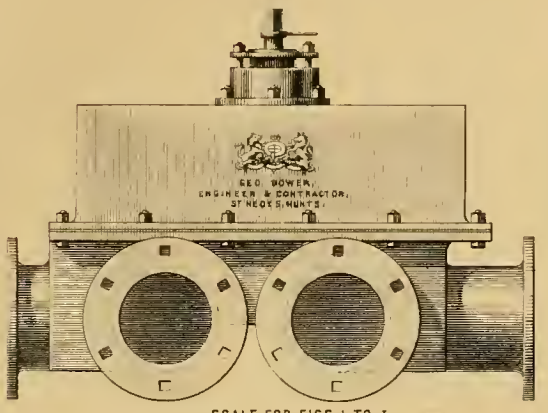
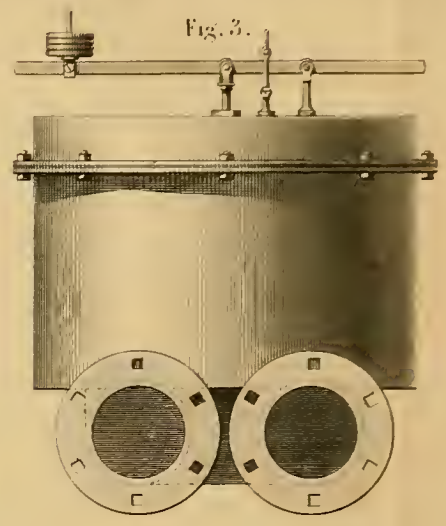


Fig.3.



SCALE FOR FIGS. 1 TO 3.

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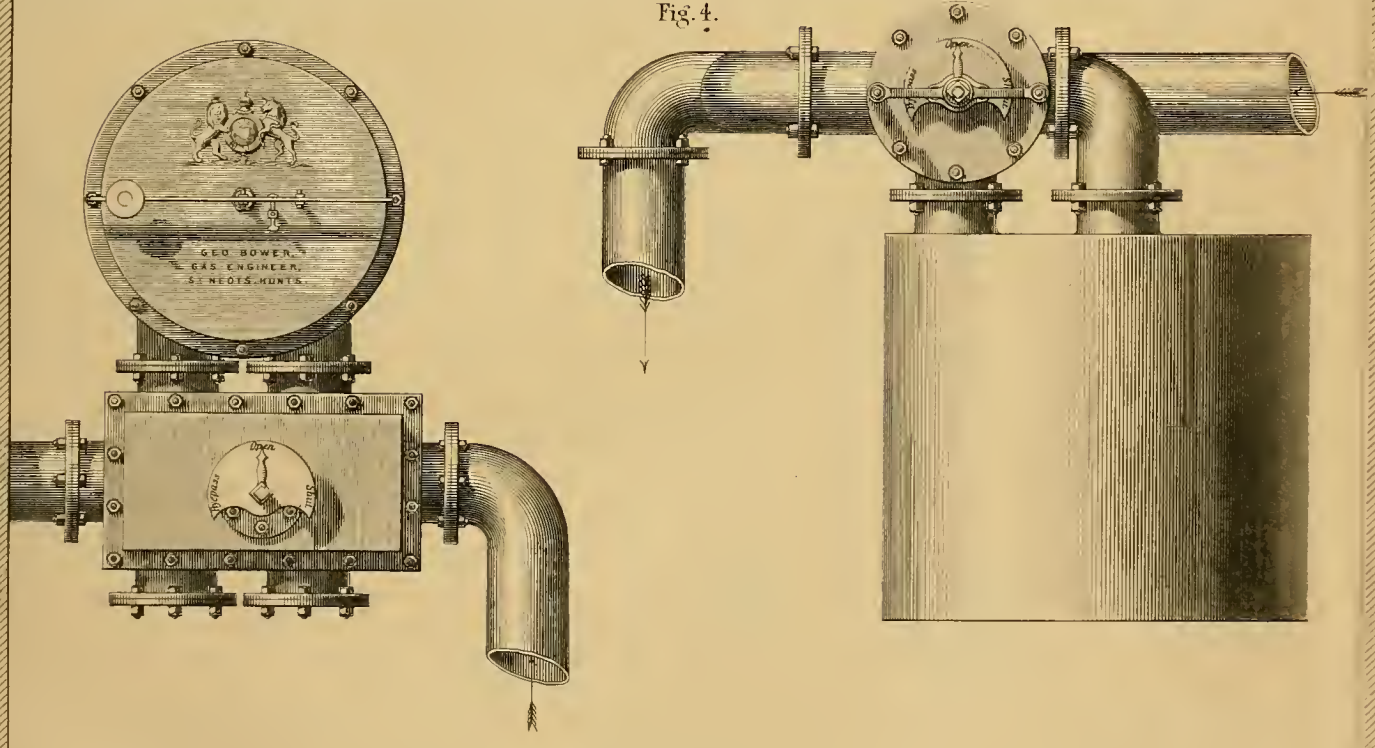
Fig.4.



SCALE FOR FIG. 4.

INS. 12 9 6 3 0 — 1 — 2 — 3 — 4 — 5 — 6 — 7 FEET.

R. Johnson, Patent Office,
Inns Inn Fields & Glasgow

BYE-PASS VALVES AND GOVERNOR FOR GAS WORKS.

By Mr George Bower, *St Neot's, Huntingdonshire.*

Illustrated by Plate 289.

Among gas engineers, who, as a body, may be ranked as a highly intelligent class, there are some who have particularly distinguished themselves by an untiring devotion in devising and carrying out improvements in the chemical and mechanical departments of their business. Others, impressed with a sense of the inestimable advantages and economy attending the use of gas as compared with the old modes of lighting, have toiled to devise apparatus that should admit of gas being manufactured on a small scale in remote places, and without incurring danger or necessitating the employment of skilled labour, in order that with the advantages of a cheaper and brilliant artificial light, labour might be carried on during the long hours of darkness in the autumual and winter months, with a degree of comfort and facility undreamed of, prior to the use of this valuable agent. So compact and efficient are these small gas apparatuses now made, that every small mill or works, nay, every farm house or isolated dwelling may be brilliantly lighted with gas at far less cost than with candle or oil, and so as to admit of a large amount of useful in-door labour being done that would otherwise probably be allowed to stand over, or not be done at all. Foremost among the few who have devoted their talent and substance to this good work, is the gentleman whose name stands at the head of this article. Mr Bower has achieved a wide and well-deserved reputation in connection with his Patent Combined Gas apparatus, his National and Vertical Retort apparatus, as well as many other minor, though not less important modifications.

In plate 289, are shown elevations and plans of two modifications of Bye-pass Valves, and of the Patent Lever Counter-balance Governor, as arranged and constructed by Mr Bower.

The bye-pass valve has become indispensable in all well-constructed Gas Works; by connecting it to the main pipes leading to and from the Scrubber, Station Meter, Governor, &c., the gas may be conducted through them, or in case they should require cleaning, adjusting, repairing, &c., the gas may be directed so as to pass by them—whence the name.

Figure 1 is an elevation of a bye-pass valve. The figure to the right of fig. 4 is a plan of the valve as connected to a Station Meter.

It is constructed on the priuciple of the ordinary plug cock; and from its conical form and mode of working it is found to keep quite tight, and by means of the gearing on the top, any difficulty arising from "sticking" is overcome—the plug being slightly eased or raised, and when turned round to its proper position, lowered down tight into its place.

This bye-pass is easily worked, extremely simple, and fully exercises the functions of three separate or ordinary valves, aud being plainly marked on the top, and provided with an index finger, no mistake can occur. It occupies one half the space with less thau one half the weight of any other bye-pass valve.

Figure 2 is an elevation, and the figure to the left of fig. 4 is a plan of another form of bye-pass valve, attached to a governor, with passages arranged for the transmission of the gas somewhat similar to those of the slide valves of ordinary steam engines. The valve chest has two extra branches, so that it can be directly couuected, whatever may be the position of the apparatus to be bye-passed. The two brauches not required having blind flanges holted on.

Figure 3 is an elevation, and figure 4 a plan of the patent lever counter-balauce govcrnor, with parabolic valve, forming a neat and compact arraugement; it is also provided with the extra branches for direct connection, similar to the hye-pass valves, figures 2 and 4.

We expect shortly to have occasion to illustrate some further improvemeuts of Mr Bower's in this direction.

RECENT PATENTS.

MANUFACTURE OF TOOTHED WHEELS.

J. H. Johnson, *London and Glasgow* (J. B. Buissart *and* T. L. Levesque, *of Paris*).—*Patent dated November* 23, 1861.

The improvements specified under these letters patent have reference to a peculiar manufacture of toothed wheels and pinions, and consist in moulding such gearing from sheet india rubber in suitable moulds—the india rubber moulded wheel or pinion being afterwards hardened in the manner usually adopted in making hard iudia rubber articles, namely, by submitting the article, whilst iu the mould, to the action of heat. The moulds employed consist of four parts, namely, a central spindle, which forms the passage or opening through the boss of the wheel or pinion, a cylindrical casing fitting the lower enlarged portion of the spindle, and forming the outside surface of the bars, an internally dented or toothed ring, for forming the teeth of the wheel or pinion, and which rests upon the top of the cylindrical casing, and a cup or cover, which rests upon the toothed ring, and forms the face of the wheel or pinion. These parts are held firmly together by means of a key or wedge and holding frame, in which state the mould is submitted to the elevated temperature required to produce the desired hardening of the india rubber. The wheel or pinion, on being removed from the mould, simply requires to be dressed or finished, so as to remove any roughness therefrom, and to equalise the pitch of the teeth. A cylindrical metal bush or tube is now inserted inside the hollow of the boss, so that when the wheel is applied to a spindle, the latter will not be in contact with the india rubber, but with the metallic lining in the boss of the wheel or pinion. In applying these wheels or pinions to spinning and twisting machines, it is proposed to form a shoulder on the spindle, and to press the pinion against this shoulder by a helical spring surrounding the spindle, and bearing against the boss of the pinion, and against a collar on the lower part of the spindle.

Fig. 1 of the subjoined engravings represents an elevation of a spindle of a spinning frame, to which is applied one of the improved pinions. Fig. 2 is a vertical section of the pinion detached; and figs. 3 and 4 represent respectively, in side elevation and vertical section, the mould adopted in making toothed wheels according to this invention. *a* is the central spindle or core of the mould, which forms the opening in the boss of the wheel or pinion. It is enlarged at its lower part, *b*, which is made convex on its upper surface, so as to leave a hollow or cup in one end of the boss of the pinion at *b*, seen in fig. 2. *c* is a ring or collar which fits accurately the enlarged shoulder, *b*, on the spindle or core, *a*, and forms the outer surface of the boss of the wheel or pinion. *e* is a ring fitted accurately on to the top of the collar, *c*, and having a number of teeth formed on its inner surface, such teeth correspondiug in size and uumber with the spaces between the teeth to be moulded in the wheel or pinion. On the top of this last-mentioned ring, is fitted the cap or cover, *f*. The mould is thus composed of four parts, which are all held firmly together by being placed inside a frame, *g*, and are then tightened up by driving in a key or wedge, *h*, between the cap, *f*, and the top of the frame, as showu clearly in fig. 4. By this means, the requisite pressure is obtaiued for forcing the prepared caoutchouc into the cavities of the mould, thus producing an exact counterpart thereof. The mould, with the caoutchouc contained therein, is then submitted to the desired temperature for hardening the caoutchouc, after which operation the mould is opened, and the wheel or pinion withdrawn for the purpose of finishiug the same, and removing any roughness or asperities from its surface. A thin metal bush, *k*, (fig. 2,) is now inserted firmly into the boss of the

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

finished wheel or piuion, a small flange, *l*, being left at the outer end of the bush to maintain it in its place, such flange resting on the face of the wheel or pinion. The pinion thus manufactured is mounted upon its spindle in the mauner showu in fig. 1, the piuion being forced against a shoulder, *n*, on the spindle, hy the action of a helical spriug, *m*, the shoulder entering the concavity, *b*, in the upper end of the boss of the pinion. The pinion gears with another piuion, also made of hardened india rubber, aud actuated by the machiue so as to transmit the requisite rotatory motiou to the spiudle. Above the shoulder, *n*, is fitted the wheel, n^1, suitably secured to the spindle. It is obvious that wheels aud pinions of all sizes and shapes may be manufactured according to this invention, and adapted, with advantage, to various differeut kinds of machinery.

ARMOUR PLATES.

JOHN TOWARD, *Newcastle-upon-Tyne.—Patent dated October* 21, 1861.

THIS inventiou bas reference to the construction of the back or inner sides of armour plates for ships, wbereby they may be secured to the sides thereof witbout weakening the plates by baving any holes drilled in them, or exposing the heads of the bolts or fastenings on the outer surface of the plates. Accordiug to tbis invention, it is proposed to form, either by rolling or forging, a series of ribs or feathers on the backs of the plates, and to plane such ribs or feathers to a dovetail section. In attaching or fixing these plates, bolts are used having their outer ends made to fit accurately, or grip the dovetail ribs or feathers, and so bold the plates firmly against the ships sides witbout passing througb the armour plates, or otherwise by having dovetail grooves or recesses formed or cut in the back of the armour plates, which are otherwise of the ordinary description; the bolt being secured therein with a key, or by being made in two halves and riveted together, or put together with screw bolts, after each half is put into the dovetail space, groove, or recess. It is obvious that the same system of securing or attaching armour plates is equally applicable to forts, or other defensive works of a similar nature.

Fig. 1, of the subjoined engraving, represents a sectional view of a ships armour plate, A, having raised ribs or projections, B, forged or rolled thereon, the ribs being of such a shape as to leave a dovetail groove or channel between them, into which the correspondingly dovetailed ends, *a*, of the bolts which secure the armour plates to the ship are inserted, in lieu of having the plates drilled, and of exposing the bolt heads, as has heretofore been the case. *b* are the nuts for tightening up the plates from the inner side of the ship. In fig. 2, the outer ends, *a*, of the bolts are forked, such forks being made to fit into dovetailed ribs, B, rolled or forged upon the inner side of the plate. The bolts may be formed in two halves, and inserted into the recesses, but it is preferable, however, to have the bolt heads solid, each inserted into its groove from the end thereof, and then moved opposite to the bolt holes made in the ship's side, whereupon the plate and bolts may he placed in their position altogether, and firmly secured by nuts or keys from the inside of the ship.

Fig. 1.

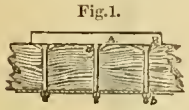


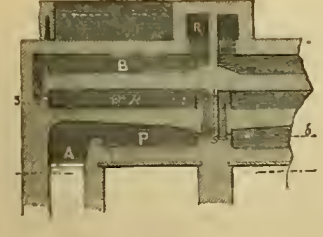
Fig. 2.

TREATING ZINC ORES.

J. H. JOHNSON, *London and Glasgow* (A. MULLER, *Paris.*)—*Patent dated November* 20, 1861.

THIS invention relates more particularly to the treatment of ores of zinc, in order to obtain metallic zinc or the oxide of zinc therefrom, and is also applicable to the treatment of phosphates, or phosphate minerals, in order to obtain phosphorous therefrom. According to this invention, it is proposed, with a view to the obtainment of metallic zinc, or oxide of zinc, to subject the ores to be treated, in combination with the proper fluxes, to an elevated temperature, in a suitable oven or reverberatory furnace, before introduciug such ores and fluxes into the blast furnace, which it is proposed to employ for the reduction and distillation of the ore of zinc, in lieu of introducing the charges in a cold state. The ovens, or reverberatory furnaces, employed in the preparatory treating of the ores and fluxes, are also intended to be used for heating the coke to be supplied to the blast furnaces, special ovens or furnaces being used for that purpose. They are made with two tiers or sets of floors, one above another, and the materials to be heated are first laid upon the upper floor, and gradually raked down through a vertical opening on to the lower and more highly heated floor, whence they are finally introduced into the blast furnace. These ovens should be erected on a level with the mouth of the blast furnace, so that the charges may be introduced into the furnace direct from the oven, without chilling the same in their transit. The lower portion of the blast furnace should be considerably contracted, as it is essential that a considerable depth of fuel should be maintained in a state of combustion, so as to assure the entire conversion of the oxygen contained in the air into carbonic oxide, and in order that the furnace should be maintained at a temperature not lower than that temperature which will effect the reduction of the oxide of zinc by the carbon or fuel, and that such temperature shall never become sufficiently lowered, so that the reduction of the oxides of zinc shall not be effected by carbonic oxide. The height of the blast furnace should be such as to preserve the necessary temperature up to the part at which the gases are taken off, but, at the same time, care being taken that the exit of the gases be not too low, so as to be effected by the oxidising action of the tageres. The exits for the gas should be disposed at the upper portion of the furnace above the charge, so as not to interfere with the working of the furnace, even when fully charged, and when under the process of distillation. The materials with which the furnace is charged should be previously raised to a temperature sufficiently elevated for the reduction of the oxide of zinc by the fuel or charcoal. Suitable condensers, culverts, and depositing chambers, are placed in connection with the blast furnace, so as to allow the gases to deposit the metallic zinc, and oxides of zinc, the fused metals being tapped out from the bottom of the blast furnace.

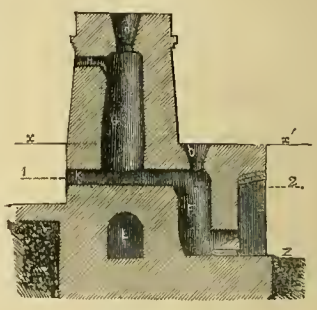
Fig. 1.



By applying this process to the treatment of the neutral or other phosphates, phosphorous may be obtained, as silicic acid, at an elevated temperature; and in presence of charcoal, will liberate phosphoric acid, which is reduced by the charcoal, and the phosphorous will distil over with the gases, and may be obtained by condensation in suitable condensing apparatus. It is also proposed to burn the mixed gases issuing from the blast furnace, and containing the metallic zinc, so as to form oxide of zinc, which may be collected in suitable condensing apparatus.

Fig. 1 of the subjoined engravings represents, in vertical section, the ovens or reverberatory furnaces for heating the ores and coke, and illustrates also the zinc furnace; and fig. 2 represents a vertical section of the zinc or blast furnace.

Fig. 2.



The apparatus is composed of a blast furnace, F, and of a reducing chamber, G, filled with coke or wood charcoal. The ore which is previously heated to a red heat, in the oven, for that purpose, shown in fig. 1, is fed into the furnace, F, through the aperture, O, which is simply closed by a brick or fire-clay lump luted therein. O^1 is the charging hole for the chamber, G, which hole should be closed by a double hopper or cover, so as to prevent the escape and loss of the vapour and the cooling of the contents of the chamber when charging. The gases are carried off by the lateral passage, H, and a corresponding passage, K, is formed at the bottom of the chamber, to facilitate the clearing of the same. The line, $x\ x^1$, indicates the level of the floor upon which are in part erected the heating or roasting ovens, or reverberatory furnaces, the ground floor of the works being shown at z. The furnace, A, fig. 1, is made duplex, and serves for the heating of the coke or charcoal. Two special hearths are employed in the heating process, the one indicated by the letter, P, serves for the coke, and the flames and heat which passes off from this hearth serve to heat afterwards the fuel intended for the chamber, G, which fuel is spread upon the hearth, *p*. The waste heat of these ovens may be used, if desired, for heating a steam boiler. The flue, Q, conducts this heat, therefore, either underneath a boiler or into a chimney, as the case may be. The oven, B, intended for the heating of the ore is also double, the flues, K, being disposed horizontally, and so as to conduct the smoke and products of combustion into one common chimney.

STEAM AND WATER-TIGHT JOINTS.

J. H. JOHNSON, *London and Glasgow* (JOSEPH HARRISON, *Philadelphia*, U.S.) —*Patent dated November* 12, 1861.

THESE improvements consist of a peculiar construction of joint suitable for steam, gas, and water pipes, or for other purposes where a perfectly tight joint is required, and consists in the combination of an open or split packing ring of copper, or other suitable metal, with a V, or angular circular groove, formed on one or both junction surfaces, or with angular or bevelled surfaces on one or both faces of the joint, in such a manner that the ring which is open, or in a slightly expanded state when placed in or upon one of the angular surfaces or grooves, shall be closed and forced into its proper place by the act of compressing the two parts of the joint together. In making the ring above mentioned, care should be taken that the two abutting ends of the piece of wire or round metal, after it has been bent into an annular form, be made perfectly square, and even so that, when forced against each other, a perfectly tight joint in the ring itself will be formed. In all cases, the ring should be slightly larger in diameter than is required for the actual joint before it is compressed by the tightening up of the two halves of such joint, so that the compression of the two parts of the

joint will at the same time effect the tight closing of the split in the ring, and so complete the efficiency of the entire joint.

Fig. 1.

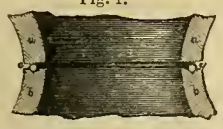


Fig. 2.

Fig. 1 of the subjoined engravings shows, in section, one form of joint constructed according to this invention, and applied to the "units" of a steam generator described in the specification of letters patent granted to the same patentees, dated 30th of August, 1859, No. 1970, and described in this *Journal*, at page 151, Vol. 5, Second Series. In this instance, an angular groove is formed on the edge of the joint of the lower piece, *b*, as shown in the engraving, the edge of the joint on the adjoining piece, *a*, being left flat; in the groove above mentioned, there is placed a ring of copper, or other metal wire, *c*, about 3-16ths of an inch thick, which ring, resting upon the angles of the groove and against the flat surface of the adjoining piece, will make a secure and tight joint, when drawn together by a screw bolt, or other means. To enable the ring above mentioned to be made with greater facility, after bending it into the circular form, the ends of the wire forming the ring are made square, and abut together, to secure perfect tightness at their point of junction. The ring is made a little too large in diameter for the groove, so that when placed therein the ring bears only on the outside angle of the groove, as shown in fig. 2. When the ring is thus placed, and the joint is to be screwed tight, the first pressure tends to force the two ends of the wire in the ring hard together, which continues until the ring bears evenly on both angles of the groove. The joints have been made with a wire ring between two flat surfaces, but it was found that the ring was liable to be forced out of place by the pressure, and, at the same time, unless the ring was soldered, it would leak at the junction of the wire. By using the angular groove, as above described, on one or both sides of the joint, both of the above evils are entirely avoided. Fig. 1 shows the joint screwed tight, with the wire forced against both angles of the groove. Fig. 2 shows (in plan) the ring slightly open at the ends of the wire before being subjected to the pressure by which the joint of the ring is brought together, and as resting or only touching the outside angle of the groove. Fig. 3 shows the same principle of making a joint as the one just described, with a slight alteration in form; in this case, the ring is made as before, but previous to bringing the two pieces together, the ring is forced into a conical opening in the upper piece, *a*, until it rests against the angular bed; the lower piece, *b*, has a single angle, against which angle the ring presses when the joint is drawn together; this joint last described has all the advantages of the former, and when it is desirable that the joint should have no tendency to move sideways, this last one might be preferred; in the former instance, stability can be given to the joint sideways by a groove in both edges of the joint, the wire ring resting in each groove. Fig. 4 represents a section of another form of joint. In this arrangement, the parts, *a* and *b*, fit one into the other, forming a species of socket joint, and the ring, *c*, is interposed between them. One of the surfaces which press upon this ring is perfectly square, that is to say, it is not bevelled or angled, whilst the other surfaces may be more or less bevelled, as shown in the engraving. By making the joint of the form shown in fig. 4, the ring is acted upon simultaneously by the three surfaces, 1, 2, and 3, two of which surfaces, viz., 2 and 3, are bevelled, so as to act at different angles upon the ring.

Fig. 3.

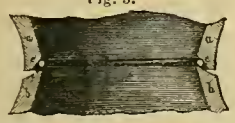
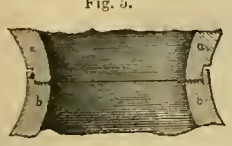


Fig. 4.

In describing the above mode of making a joint, in combining the wire ring with the angles on the castings, the patentee does not confine himself to any special form of wire ring, or to any special form of groove or angle, but reserves the right to adopt any form of wire ring or groove, provided the groove is so made as to close the ends of the wire together when the ring is made a little too large, and where the groove or grooves admit the ring to be so placed as to effectually prevent it from being forced out of its place by the pressure against it. The making a steam or water tight joint, by the introduction of a copper or other metal ring between the parts, has long been known, and the patentee lays no claim to it in this respect, but to the improvements in the combination of the angles, as above described, with the wire ring, and manner of making the ring without soldering, for the purpose of making a tight joint for steam or other purposes. In fig. 5 is also shown a simple and effective joint in which the ring is dispensed with, but no claim is laid to this particular formation of joint. In making this joint, the part, *b*, is made to enter the part, *a*, so as to form a socket joint; and on one of the two surfaces which abut against each other when the joint is tightened up, as in fig. 5, there is a series of annular V grooves, cut so as to leave sharp, angular, inverted shaped ridges thus (^), upon such surfaces. The part, *a*, is made flat, at the junction surface, and this flat part is forcibly pressed against the sharp edges of the projections, formed on the part, *b*, so as partly to crush them or embed them into the metal of the part, *a*, thus effectually closing the joint steam and fluid tight.

Fig. 5.



WATER AND STEAM COCKS.

J. C. Heaton *and* John Dean, *Rotherham.—Patent dated October* 24, 1861.

These improved taps or cocks are composed simply of three or four parts, namely, the barrel, the valve, and a screw cap, or screw cap and spindle; the screw cap, when used without the screw spindle, serving the threefold purpose of the plug, the crutch, and the cap.

Fig. 1 of the accompanying engravings represents a longitudinal vertical section of one form of the improved tap or cock, as applied to high-pressure service. A is the body of the cock in one piece, with the barrel, B, within which, and at the centre thereof, is formed the valve seat, C. D is the valve face, formed of a washer of leather, vulcanised india rubber, or other suitable material, which is secured by a central screw to the bottom of the valve stem, E. The upper part of the valve stem is provided with a cup leather, or other suitable packing, *b*, inside, that it may work freely, but, at the same time, water-tight within the barrel of the cock. F is the cap or cover which is screwed on to the top of the barrel, B, being provided with a suitable crutch handle, G, for that purpose. This cap or cover bears upon the extreme upper end of the valve stem, or spindle, and serves to hold the valve down upon its seat, or in its closed position. When, however, the valve is to be opened, the cap or cover is turned so as to raise it, whereupon the pressure of the water will immediately force the valve open. By turning the cap in the reverse direction, it will press upon the valve stem, and so close the valve again. *c* is a small stop or check screw

Fig. 1.

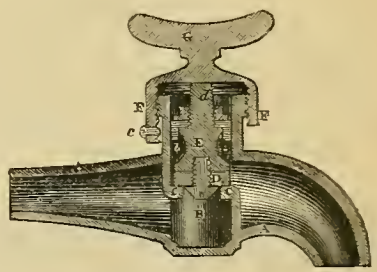


Fig. 2.

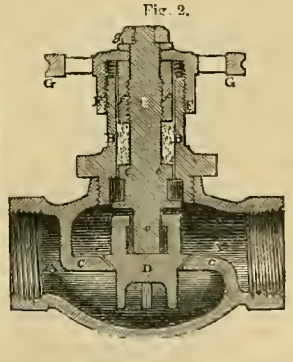
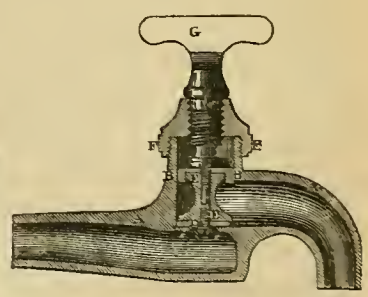


Fig. 3.



for the purpose of preventing the accidental separation, or entire unscrewing of the cap or cover from the barrel. In another modification, adapted to low pressure, where there is not sufficient force in the water to open the valve of itself, the valve stem is swivelled at its upper end to the interior of the cap or cover, so that when the cap is elevated by partially unscrewing the same, it will simultaneously lift and open the valve, the action in closing being precisely similar to that before described. Fig. 2 is a longitudinal section of a slightly modified form of cock adapted for steam pipes. In this cock, a metallic mitre valve, D, is employed, fitting a corresponding valve seat, C, and connected by a swivel joint to the lower end of the valve stem, E, which

works inside the barrel, B. A collar, *e*, is formed on the lower portion of the stem, E, which collar is capable of sliding freely up and down the barrel, B, suitable packing being applied round the stem for the purpose of maintaining the cock steam-tight. A collar, *f*, is screwed on to the upper end of the valve stem, so as to tighten the packing which is thus compressed between the two collars, *e* and *f*. The upper end of the collar is made to bear against the underside of the cap or cover, F, so that when the cover is screwed down it will close the valve tightly by pressing upon the collar, *f*. As the valve stem, E, is connected by means of the nut and washer, *g*, to the cap or cover, it follows that on partially unscrewing or elevating the same the valve will be elevated with it, and consequently opened. In lieu of applying the crutch handles to the cap or cover, a hand wheel, C, is formed thereon similar to those usually employed in steam valves. Fig. 3 represents a sectional elevation of a slightly modified form of high pressure cock, wherein, in place of the cap, F, effecting the opening and closing of the cock, a screwed spindle is used, *f*, provided with the ordinary crutch, G, for that purpose, such spindle working through a central tapped hole in the cap, and bearing upon the top of the valve stem, as is clearly shown in the fig. 3; the valve is thus closed by screwing down the spindle, and allowed to open by the reverse action. If desired, the valve stem may be swivelled to the screw spindle, *f*, for low pressure cocks, so that the raising of the screw will lift up and open the valve. In all these cocks, the stuffing box is entirely obviated.

STEEL TUBES.

L. Christoph, W. Hawksworth, *and* G. P. Hardings.—*Patent dated October* 10, 1861.

This invention relates to the manufacture or production of tubes of a cylindrical, conical, or other form, from cast steel, or other metals and alloys, and consists in making conical, cylindrical, or other shaped tubes, without welding, by a peculiar mode of drawing or rolling, or drawing and rolling combined, either in a hot or cold state. In drawing or rolling tubes of an uniform diameter throughout, according to this

Fig. 1.

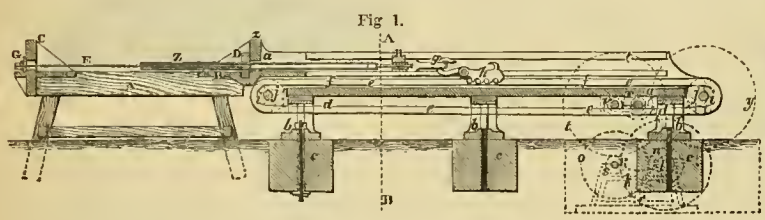
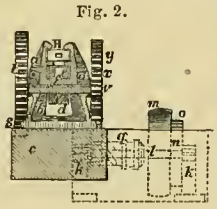


Fig. 2.



invention, a peculiar form of mandrel is employed, having two or more swellings or enlargements thereon; the one which comes into action first being rather smaller than the others, which should be of a gradually increasing size. The draw plate to be employed with these mandrels is made considerably thicker than the ordinary "draw plate" or "wordle," and has a conical draw hole or aperture therein to correspond to the graduated sizes of the enlargements on the mandrel. In the making of conical or tapered tubes, such, for example, as are required for gun barrels, a conical mould or matrix is employed, into which a tube is introduced, after it has been rolled to a tapered form, and through this tube a mandrel, similar to the one above described, is drawn, so as to expand and elongate the tube, until it entirely fills the conical mould or matrix, the result being a conical tube with a cylindrical bore. This tube may have rifle grooves indented or drawn therein, in lieu of cutting such grooves, by using a mandrel having suitable projections thereon, and to which a proper rotatory motion is imparted during the time it is being drawn through the tube or barrel. The tubes or blanks are originally produced, either by casting in the form of hollow cylinders, or piercing or boring them from a solid bar or block, or by punching. The steel to be used in the manufacture of tubes should be of a pure and highly ductile nature, in order that it may be readily worked, either hot or cold, by the drawplate, and mandrel, or rolls. The machine and other mechanism employed under this invention are as follows.

Fig. 1 of the subjoined engravings represents a longitudinal vertical section of one arrangement of draw bench, for drawing cold cast steel tubes, without weld, according to this invention. Fig. 2 is a transverse vertical section of the draw bench, taken on the line, A, B, in fig. 1. The main framing, *a*, of the draw bench is cast in one piece, and is mounted upon the wrought iron supports, *b*, which are bolted down upon the brickwork, *c*. The main frame is composed of a lower rectangular box, *d*, intended to receive one end of the endless chain, *e*, and of an upper box, *f*, containing a complete system of hinged grippers, *g*, and attaching hook, *h*. These two cases or compartments are parallel to each other, and are situate, one over the other, throughout the entire length of the frame.

At the two ends are fixed the bearings, *i*, which carry the shafts of the endless chain pulleys or wheels, *j*. The driving gear is situate at the front end of the machine, and consists of two standards, *k*, which support the main driving shaft, *l*, drawn by a pulley, *m*, which receives its motion from any prime mover. Upon this shaft, *l*, is fixed a pinion, *n*, which gears with the spur wheel, *o*, a disengaging clutch box, *p*, being also fitted on the same shaft. This clutch is actuated by the combined action of levers, and is capable of being operated upon by the attendant at any part of the machine. The wheel, *o*, mounted upon the shaft, *r*, which carries at one extremity a pinion, *s*, gearing with the spur wheel, *t*, on the shaft, *u*, and at the other end is fitted a pinion, *v*, which gears with the intermediate wheel, *x*, driving the wheel, *y*, fitted on to the axis of the chain wheel, *j*. This train of gearing is so arranged as to reduce the speed of the machine, and so prevent heating of the parts when at work. At the opposite end of the framing is a bracket or upright, *z*, having a circular aperture made therein, corresponding exactly to the position of the aperture of the draw plate.

In the draw bench is fixed a wooden table, A, by means of the lug or flange, B, which is bolted to it. This table, A, which is firmly fixed into the ground by four legs or supports, carries, at its outer extremity, a cast iron bracket or upright, C, firmly secured thereto by bolts, also having a circular aperture made therein. The draw plate or "wordle," D, shown in face view and section in fig. 3, is of a rectangular form, and about four inches in thickness; it is perforated with a number of conical or tapered holes, rounded at the inner edges of a gradually decreasing diameter, their sizes varying, of course, according to the size of tube to be drawn.

In combination with this draw plate, is used a series of correspondingly graduated mandrels, E, the head or acting extremity of one being shown in fig. 4. These mandrels are formed with two or more swellings or enlargements at their acting extremities, the enlargement gradually diminishing in size from the end one, as 1, 2, 3, in fig. 5, so that, when in operation, as shown in figs. 1 and 5, the smaller swelling will first act upon the tube, and the larger ones will succeed it, thereby gradually reducing the thickness of, and expanding the metal between the circumference of the mandrel and the wordle, or the enlargements may be all made of the same size, as well as of the draw plate, D. In making drawn steel tubes, according to this invention, a small cylindrical piece of cast steel, of sufficient ductility for drawing, is first taken, and having had an opening drilled or otherwise forced through it in the direction of the axial line of the cylinder, and of sufficient diameter to allow of the passage there through of the stem of the mandrel, E, it is passed on to the mandrel, and the latter is secured to the bracket, C, fig. 1, by means of the nut, G, after having previously passed over the piece of steel, the draw plate, D, figs. 1 and 3, and secured it to the draw bar, H. It is obvious that so soon as the draw bar, H, is entered upon in a retrograde direction, by means of the hook, *h*, and endless chain, *e*, the piece of steel or short hollow cylinder being forced or drawn between the interior of the aperture in the draw plate, D, and the

Fig. 3.

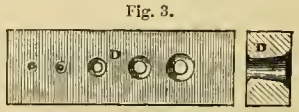
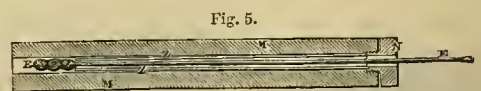


Fig. 4.

exterior of the enlargements on the mandrel, E, will be of necessity elongated into the tube, Z, of any thickness and bore, according to the sizes of the aperture in the draw plate, and the enlargements on the mandrel. When large pieces of steel are to be operated upon, it is necessary to subject them in succession to a series of apertures and mandrels of a gradually decreasing diameter.

In the manufacture of drawn conical steel tubes, a cylindrical tube is

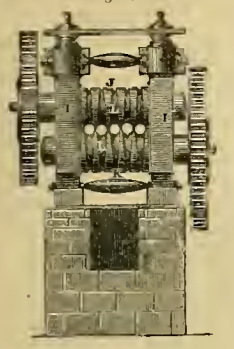
Fig. 5.



first produced by drawing as before described, and then this tube is passed through a pair of rolls, having tapered grooves or channels made therein in lieu of parallel ones. Fig. 6 represents a front elevation of a conical tube rolling mill. This mill consists of a pair of standards, I, and one or more pairs of rolls, J, K, having a series of semicircular grooves or channels, L, made therein of a conical or tapered form. The tube to be rolled has a mandrel inserted therein, in order

to prevent it from being crushed or flattened, and as the series of grooves or channels in the rolls are of a gradually decreasing size, the tube may be reduced to any desired diameter, by passing it successively through the different grooves in the rolls. It is obvious that any section of tapered tube, other than circular, may be produced as oval, flattened, polygonal or otherwise by having the grooves of a corresponding form whilst the bore of the tube may be made either to corespond in section to the shape of the tube, or be cylindrical throughout. The desired taper of the tube having been thus obtained, it is finished by interual drawing, that is to say, by drawing a mandrel through the tube whilst the tube itself is held in a species of mould or matrix shown in longitudinal section, figure 5. The mould, M, is made lightly tapered or conical inside, and is provided at the smaller end with a strong screw plug, N, secured therein. The tube, Z, to be finished, is introduced into this mould after leaving the rolls, and a mandrel, E, having the three enlargements, 1, 2, 3, formed thereon, is introduced into the tubes; the smallest enlargement, 1, entering the end of the first, and being followed by the two larger ones, 2, 3, in succession. The stem of the mandrel is passed through the plug, N, which is made hollow for that purpose, and is secured to any convenient driving apparatus, as shown in fig. 1; whilst the mandrel is being drawn through the tube the latter is held in position by bearing against the inner end of the plug, N, as shown. The action of the mandrel is to force out or expand the sides of the tube against the interior of the matrix, and at the same time to smooth the bore of the tube and leave it perfectly parallel. This apparatus will be found of great service in making gun barrels, and when it is desired to rifle a barrel, a mandrel may be used, such as shown at fig. 4. The enlargements in this case being in the form of projecting feathers, or toothed so as to indent the rifle grooves in the barrel in lieu of cutting such grooves; but to accomplish the rifling, is it obvious that as proper rotatory motion should be imparted to the mandrel or to the barrel at the time it is being drawn through the interior of the tube. In some cases, parallel tubes may be taken direct from the draw bench and placed inside the matrix, fig. 5, where they are rendered round by the sole action of the mandrel and matrix, but it is prefered to submit the tubes previously to the action of the rolls before referred to.

Fig 6.



LAW REPORTS.

PARAFFIN OIL: TRADE MARK.—YOUNG *v.* MACRAE.—INJUNCTION.—This was a motion in the Vice-Chancellor Court, before Sir W. P. Wood, for an injunction to restrain the defendant from selling, under the name of "paraffin oil," or "American paraffin oil," any oil or similar product not manufactured by the plaintiffs, and from selling any such oil under any other name, so as to induce the public to believe that the oil had been manufactured by the plaintiffs or their licensees. The case made out by the plaintiff was that Mr Young, the original patentee, had in 1850 invented a process for obtaining "paraffin," and oils containing paraffin, and had in his specification called the oil containing paraffin, "paraffin oil." The plaintiff alleged that this name was a mere arbitrary term, selected and used by Mr Young, and that it did not denote any specific chemical substance. The term "paraffin" was admittedly not new, having been used by Reichenbach, a German chemist, to denote a solid substance derived from the distillation of schist or peat, the term having been composed from the two Latin words *parum* and *affinis*, in allusion to distinctive qualities of the substance. The plaintiff obtained a prize medal at the Exhibition of 1851 for his "paraffin oil" there exhibited. Large quantities had since been made under the process and sold as "paraffin oil," and the term had thus become known to chemists and the public as denoting exclusively, as the bill alleged, oil manufactured according to the plaintiff's process. It appeared that large quantities of oil similar in character are now produced by the distillation of "petroleum," or rock oil, recently discovered in America. The plaintiff alleged that the defendant had been actually selling this recently-invented oil under the name of "paraffin oil," or "American paraffin oil," and that it was of a highly explosive and inflammable character. Conceiving that the reputation of his invention would be injured by the sale of an inferior article under the same title, the plaintiff had filed his bill, and now moved for an injunction, on the ground that he had appropriated and acquired for himself the exclusive right to the title "paraffin oil."

The evidence of chemists and others, of a very voluminous character, was adduced for the purpose of showing that the term "paraffin," although invented by Reichenbach in 1830, was new as applied to oil, and had not come into use among chemical writers until after the plaintiff had patented his invention.

The defendant stated that he had not sold his oil under the term "paraffin oil" until pressed for oil of that name by an agent sent to his warehouse by the plaintiffs. He also entered into evidence in opposition to that of the plaintiff, but, as his counsel were not called upon, it is unnecessary to enter into any detail as to the case set up on his behalf.

Mr Rolt, Mr Charles Hall, and Mr Rowcliffe, for the defendant, were not called upon.

The Vice-Chancellor said that the motion must be refused. Had the term "paraffin" been one of those fanciful titles without meaning, like "medicated Mexican balm," with which this Court had been familiar, care would be taken to restrain the use of such a term by other persons. But paraffin was a well known substance, a useful adaptation of which had been invented by the plaintiff. The title, therefore, was not a mere fanciful one, in which the plaintiff could claim anything in the nature of a trade mark, but denoted the article produced. Take the case of sugar extracted from beetroot, although one person might for ten years have discovered the process of extraction, and enjoyed the sole right, would there be anything to restrain a person using a different process for the same end from calling his sugar also by the term, "beetroot sugar?" If any one had found a different process for producing the same article he must call it by the same name. It would appear from the evidence that the term "paraffin" had been first brought into commerce by the plaintiff; but then it was a term which any one would easily adopt in speaking of a substance so manufactured. The only doubt that had arisen was as to the defendant calling his oil "paraffin oil," when it was not the same article as that manufactured by the plaintiff. But the defendant added the term, "American," and he should not assume that he had acted with *mala fides*. Besides these difficulties which stood in the plaintiff's way, it was to be observed that in obtaining a sample of oil from the defendant's warehouse he had carried the spy system to an extreme length. In fact, he had stimulated the dealer in this article into dealing in it. He had insisted on having the words "paraffin oil" written in the invoice and receipt. The observation of the plaintiff's counsel was, indeed, just, that the circumstance of the defendant being driven into using these words showed that he knew he was doing wrong in using them. If there had been any case of a sale of the defendant's oil as "paraffin oil" to any other person except the plaintiff's agent who drove him into committing the alleged offence, that might make a great difference. But where it was doubtful whether any offence had been committed, and that if it were an offence the defendant had been driven into committing it, in such a case the Court would not interfere by injunction. The motion, therefore, would be refused, and the costs would be costs in the cause. His Honour added that his present impression was that the plaintiff would have great difficulty in making out his case at the hearing.

MANUFACTURE OF SIZE: CALVERT AND OTHERS *v.* ASHBURN.—Queen's Bench, May 30.

The plaintiffs in this action obtained a patent on the 25th of November, 1858, for improvements in the manufacture of size. Their specification states that their "invention consists in the application of caustic alkalies for the purpose of dissolving the gluten or proteine matter contained in the flour and amylaceous substances employed in the manufacture of size; such gluten or proteine matter, in its undissolved state, being disadvantageous to the free working of the size." It also states that, "by the ordinary process, this gluten or proteine matter is partly destroyed or rendered soluble by subjecting the flour to fermentation before converting it into size by boiling;" and adds, "We find that a considerable destruction of the starchy matter of the flour also takes place during this fermentation process, sometimes amounting to as much as 50 per cent., which destruction our invention obviates, and causes both the starch and gluten to become available as size."

The plaintiffs conceiving that the defendant had infringed their patent brought the present action.

At the trial, several objections were taken to the plaintiffs' patent, the chief being that the invention was not new, it being proved that caustic alkalies had been used in the manufacture of starch for the purpose of getting rid of the gluten. The plaintiffs sought to avoid this difficulty by contending that, in their process, the caustic alkalies were not used in order to destroy the gluten, but only to dissolve it, and, by subsequent boiling, to make the gluten so dissolved available to size.

The plaintiffs, however, obtained a verdict subject to leave to the defendant to move to set it aside, and enter a verdict for nonsuit on the ground of the invalidity of the patent. Such a rule having been obtained, and argued back, Lord Chief Justice Cockburn said he felt bound to give his judgment against the validity of the plaintiffs' patent. His Lordship said he thought the plaintiffs had made an ingenious

discovery, but it turned out, unfortunately for them, that they had been anticipated by others who had adopted the same process—viz, that of applying caustic alkalies for the purpose of dissolving gluten in the manufacture of starch. The plaintiffs had applied to size-making the same process which had previously been applied to starch-making, but that was not the subject of patent. The rule therefore (to enter a verdict for the defendant) must be made absolute.

Mr Justice Wightman and Mr Justice Blackburn being of the same opinion, the rule was accordingly made absolute.

During the discussion upon the above case some observations were made by the Court upon the proposal recently made in Parliament for the establishment of a new tribunal for the trial of patent causes.

Mr Bovill said a commission was to be issued to inquire into the matter, and it would be very desirable if their Lordships would favour the country with their opinions upon the question.

Lord Chief Justice Cockburn.—We should be very interested witnesses.

Mr Bovill said that recently two attempts had been made to try patent causes in the Court of Chancery,—one with a jury, and one without a jury; but the learned counsel could not say whether the learned judges in Chancery could report satisfactorily of the mode of trial. In one case a judge in the Court of Chancery stated that it took him a whole week to understand one patent case.

Mr Justice Wightman observed that in the case before the Court the scientific witnesses were not agreed.

Lord Chief Justice Cockburn said the scientific witnesses neither agreed in theory nor in the result of their experiments.

Mr Bovill added that there were now before the Court affidavits of the most conflicting character upon those questions of science made by scientific gentlemen.

Power Loom Temples: Norton *et al.*, *v.* Brooke—Refusal to pay under Contract for License.—This was an action at Liverpool before Mr Justice Mellor and a special jury; and it was brought by the patentee of an ingenious apparatus for stretching cloth in the process of weaving it in the loom, against the defendant, who had taken out a license to use the patent, and who refused to pay under his contract.

The case having been opened, after a consultation between the learned counsel, it was agreed that the plaintiff should have a verdict for £250, and that defendant's license should be renewed for the duration of the patent.

Capsules.—Betts *v.* Menzies.—*House of Lords, June* 5.—This is the case which in one court or other has been so often noticed in our pages. The decisions having been hitherto adverse to the plaintiff, he carried it to the final court of appeal, which has decided in his favour. We may here recapitulate that the original action was brought by the appellant in the present proceedings against the respondent for the alleged infringement of a patent, granted in 1849, for making metallic capsules for bottles, which is effected by placing an ingot of lead one fourth of an inch thick upon an ingot of tin one-twentieth of an inch thick, and passing them through the rollers of a flatting mill, which causes the two metals to unite, and form a tough, flexible, and silvery-looking sheet. The case was tried in 1859 before Chief Justice Erle, when the respondent contended that the patent was bad for want of novelty in the invention, which had been described in a specification of a patent granted to one Thomas Dobbs in 1804. The jury found a verdict for the plaintiff on all the issues, subject to leave reserved for the defendants to move the Court above to enter the verdict for themselves on the first and second pleas. The defendants having obtained a rule *nisi* to set aside the verdict for the plaintiff, and to enter a verdict for themselves, it was subsequently made absolute, the Court of Queen's Bench being of opinion that Dobbs's invention anticipated the plaintiff's. The plaintiff appealed to the Court of Exchequer Chamber, which, in July, 1860, affirmed the decision of the Court of Queen's Bench. Hence the present appeal. The contention before their Lordships on behalf of the appellant was that the judge at Nisi Prius was right in leaving the case to the jury, that the evidence was properly admitted at the trial, and that it was for the jury to decide what effect they would give to it in reference to the question as to the novelty of the plaintiff's patent. It was further contended that the question whether the plaintiff's patent was made void for the want of novelty by the publication of Dobbs's specification was one partly of law and partly of fact, and that therefore the Court alone was not competent to decide it without the facts being admitted by both sides, which was not the case in the present instance; and that before the Court could decide it must be informed of the meaning of the technical terms in Dobbs's specification, what were the nature and properties of the metal in the different states described in the two specifications, and of the effects of the operations described upon the metals in those different states. If the decision of the Court of Exchequer Chamber that the plaintiff's patent was void on account of the prior publication of Dobbs's specification was to be taken as a correct decision upon a point of pure law, then it must be so on grounds independent of evidence, and no possible evidence in addition to the two specifications could affect the correctness of that decision. So that if Dobbs himself had proved that his patent was taken out on a conjecture, and that he had never known the thing to be done, and did not know how to do it, his specification would still have invalidated the plaintiff's patent. The specification of Dobbs's patent could not invalidate the plaintiff's patent unless it were admitted by the plaintiff or found by the jury that Dobbs had specified something that could be put in practice. As to whether Dobbs's specification were practicable or not, that was entirely a question for the jury, who had decided the point in the plaintiff's favour. In conclusion it was contended that it was impossible to ascertain the meaning of Dobbs's specification as a matter of law without evidence. The counsel for the respondent contended on the other hand that the plaintiff's invention, or some material portion of it, was included in Dobbs's specification, and that therefore the plaintiff's patent was bad for want of novelty; that the construction of Dobbs's specification was for the decision of the Court, who were bound to take the words in their ordinary sense; and that the plaintiff's specification was ambiguous and uncertain in not pointing out the proportions of lead and tin to be employed when the combined metal was to be used for other purposes than making capsules, and in not distinguishing between what was new and what was old at the date of the patent.

The case was argued some time ago before their Lordships, and some of the judges, when the following questions were put to the latter:—"Does it appear, on a comparison of the two specifications, that a material part of Dobbs's specification is claimed by Betts in his specification? If so, can the Court pronounce Betts's patent to be void simply on the comparison of the two specifications, without evidence to prove identity of invention, and also without evidence that Dobbs's specification disclosed a practicable mode of producing the result or part of the result described in Betts's patent?" The judges answered both questions in the negative in February last, when their Lordships postponed judgment.

The Lord Chancellor, in now delivering judgment, said—My Lords, in this appeal, the appellant, who was the plaintiff below, brought an action against the respondents for an infringement of his patent. The date of that patent was the 13th of January, 1849. One of the issues raised in the action was the alleged want of novelty in the invention of the plaintiff. The jury found a verdict for the plaintiff on all the issues. The defendants had leave reserved to them to enter a verdict for themselves on the issues founded on the first and second pleas.

The second plea was, that the plaintiff's invention, or a material part of it, was included in the specification of a patent granted to one Thomas Dobbs, in the year 1804. The Court of Queen's Bench were of opinion that on that second plea the rule ought to be made absolute. The plaintiff appealed to the Court of Exchequer Chamber, where, by a majority of the judges, the judgment of the Queen's Bench was affirmed. From that judgment so affirmed, the present appeal is brought to your Lordships' House.

My Lords, the question was very learnedly and ably argued before your Lordships, assisted by several of the learned judges, and your Lordships thought fit to put to them two questions. Upon a reconsideration of these questions, I think it will appear that probably the first becomes immaterial to be considered, supposing the second question was answered in the negative. All the judges have concurred, for reasons which I think must be extremely satisfactory to your Lordships, in answering the second question in the negative. There does not appear to have been quite the same unanimity of opinion with regard to the answer to be given to the first question; but in reality, the second question being answered in the negative, the first question can hardly be said to arise.

My Lords, the second question was this, "Can the Court pronounce Betts's patent to be void simply on the comparison of the two specifications, without evidence to prove identity of invention, and also without evidence that Dobbs's specification disclosed a practicable mode of producing the result, or some part of the result, described in Betts's patent?"

The answer of the learned judges involves, therefore, two conclusions, which are extremely material to the Patent Law. One is this, that even if there be identity of language in two specifications, remembering that those specifications describe external objects, even if the language be verbatim the same, yet if there be terms of art found in the one specification, and also terms of art found in the other specification, it is impossible to predicate of the two with certainty that they describe the same identical external objects, unless you ascertain that the terms of art used in the one have precisely the same signification, and denote the same external objects at the date of the one specification as they do at the date of the other.

And, my Lords, this is obvious, for, if we take two specifications dated, as the present are, one in the year 1804, and the other in the year 1849, even if the terms employed in the one were identical with the terms employed in the other; supposing that each of them contains a term of art, we will assume it to be a denomination of some engine, some instrument, some drug, or some chemical compound, it might well be that the thing denoted by that name in 1804 is altogether different from the thing denoted by that name in 1849. If it were necessary to enter into such a subject I could give numerous examples, say from chemistry, of things that were denoted by one name in 1804, and which have retained the same denomination, but, which, by improved processes of chemical manufacturers, are at present perfectly different in their results, their qualities and their effects from the things denoted by the same names 40 or 50 years ago. It is perfectly clear, therefore, that if you compare two specifications, even if the language be the same, you cannot arrive at a certainty that they denote the same external object, and the same external process, unless you enter into an inquiry and ascertain as a fact, that the things signified by the nouns substantive contained in the one specification are precisely the same as the things signified by the same nouns substantive contained in the other. In all cases, therefore, where the two documents profess to describe an external thing, the identity of signification between the two documents containing the same description, must belong to the province of evidence, and not the province of construction.

My Lords, I pass on to the next conclusion, which is involved in the answer of the learned Judges to your Lordships' question, and that conclusion, I think, is also of great importance to the law of patents, because it results from that opinion that an antecedent specification ought not to be held an anticipation of a subsequent discovery, unless you have ascertained that the antecedent specification discloses a practicable mode of producing the result which is the effect of the subsequent discovery. My Lords, here we attain at length to a certain, undoubted, and useful rule. For the law laid down with regard to the interpretation of an antecedent specification is equally applicable to the construction to be put upon publications, or treatises previously given to the world, and which are frequently brought forward for the purpose of shewing that the invention has been anticipated. The effect of this opinion I take to be this: if your Lordships shall affirm it, that a barren general description, probably containing some suggested information, and involving some speculative theory, cannot be considered as anticipating, and as therefore, avoiding, for want of novelty, a subsequent specification or invention which involves a practical truth, which is productive of beneficial results, unless you ascertain that the antecedent publication involves the same amount of practical and useful information.

Now, my Lords, it will be evident upon a comparison of these two specifications, that the one was a mere general suggestion, while the other is a definite practical invention. It is possible that a suggestion such as that contained in the one may lead to the discovery of the invention contained in the other. But it is the latter alone which really does add to the amount of useful knowledge; it is the latter alone, which, by its practical operation confers a benefit upon mankind within the meaning of the patent law. In the present case there was not only no evidence to show that which was contained in Dobbs's specification was capable of practical operation, but in reality that conclusion was negatived by the verdict of the jury. Therefore, my Lords, concurring, as I entirely do, in the conclusions which have been arrived at by the judges, in answer to the second question, it results, as a necessary consequence, that the decision of the Court of Queen's Bench, and of the Court of Exchequer Chamber ought to be reversed, and that the rule *nisi*, made absolute by the Court of Queen's Bench, ought to be discharged. My Lords, I move your Lordships, therefore, to embody these conclusions in your present order.

Lord Brougham.—My Lords, in the course of the argument I had and expressed very considerable doubts on various parts of the case. Upon the whole, I consider those doubts as answered by the learned opinions of the learned judges, and I agree with my noble and learned friend's proposition.

Lord Cranworth.—My Lords, the only question in this case is, whether the plaintiff's invention was new. The jury found that it was. He is, therefore, entitled to judgment in his favour, unless, as a matter of law, the jury could not, on the evidence before them, lawfully come to the conclusion at which they arrived; in other words, unless there was evidence before the jury, which made it their duty, as a matter of law, to find that the invention was not new.

The argument for the respondents was, that the absence of novelty was established conclusively by the production of Dobbs's specification; that in the face of that specification the jury could not find in favour of the plaintiff; and this was the opinion of the Court of Queen's Bench, and afterwards of the Exchequer Chamber. But I agree with the able opinions of the minority of the judges in the Exchequer Chamber, and of the learned judges, whose assistance we had at the argument of this case, that the judgment below was wrong.

It may be true that two specifications may be so entirely identical that the judge may be warranted in telling the jury, as a matter of law, that they cannot find the second invention to be new, though that was not decided in Bush *v.* Fox; for there the jury had found, as a matter of fact, that the mode of working the two inventions was the same.

But here not only are the two specifications not identical, but in the earlier of them there is no trace of that which constitutes the very essence of the plaintiff's invention, namely, the relative thickness of the tin and the lead, and the mode of rolling and laminating each metal separately before they are placed together, and then made to cohere by being rolled and laminated jointly.

Dobbs's specification disclosed no more than his notion, that tin and lead might, by means of pressure, be so combined as to form a new and useful material. But it gave no information as to how that object could be attained, and there was evidence to show that Dobbs had never been able, in working according to his specification, to succeed in making the metals unite. There, was therefore, an essential difference between the two specifications which fully warranted the jury in finding a verdict for the plaintiff as they did.

The case has been so fully and ably discussed in the opinions of the learned judges, and commented on by my noble and learned friend on the Woolsack, that I shall content myself with simply saying that I concur in the motion that judgment be given for the plaintiff below who is appellant here.

Lord Wensleydale.—My Lords, the result of the very full and able opinion delivered by my Lord Chief Baron, on the questions propounded by your Lordships, and of the written opinions of the consulted judges, with which we have been supplied, is that the unanimous judgment of the Court of Queen's Bench, and the judgment of the majority of the Court Exchequer Chamber, ought to be reversed. I concur entirely in the propriety of this course. It appears to me, without entering into all the questions which have been discussed at the bar, and on most of which the learned judges have delivered their opinions, that my noble and learned friend who has addressed the House, has put the case on a ground which is quite satisfactory, and it appears to me it is perfectly unanswerable. The jury, having found that the plaintiff's invention was new, unless the production of Dobbs's specification, without any other evidence conclusively shewed that it was not; the patent must be good. Now I am clearly of opinion that the mere production of Dobbs's patent, in which he makes public his notion that lead and tin might be usefully combined in a new material by mechanical pressure, without any statement or proof how that object could be obtained, and a practical result secured, is insufficient to shew that he had made prior discovery and was an inventor. If nothing was set out in the plea but the plaintiff's and Dobbs's prior patent and specification, it would, I think, be unquestionably bad. It is not a disclosure of an invention.

I agree entirely with Mr Justice Williams and Mr Justice Willes in their opinion given in this case, in the Court of Exchequer Chamber, that the mere publication of a notion that a particular article might be made, without any information or means of knowledge communicated to the public, does not preclude a subsequent first inventor of those means from taking out a patent.

Very early in the argument it appeared to me that without some evidence to show that Dobbs's patent is capable of a practical application, and would produce some useful effect, it was inoperative to affect Betts's invention and to render his patent invalid, and it is much to be regretted that this view of the case was not fully discussed at an earlier period.

Judgment appealed from reversed, and judgment given for appellant.

This case has an important bearing on the law relating to the interpretation of specifications. (See Patentee's Manual, second edition, page 86.) It has decided that even where there is an identity of language in two specifications, if such identity consist merely in technical terms, it must be considered impossible for a judge to predicate what exact meaning the first patentee attributed to such terms, if any long interval of time elapsed between the two specifications. Under such circumstances a judge ought not to take upon himself to decide as to the identity of the inventions guided only by the similarity of the language. He cannot assume that the inventions are substantially the same because the expressions employed are similar. The identity, or dissimilarity, is a fact which a jury must decide upon the evidence laid before them. Further, it has been decided that a suggestion, however important, in a specification, is not to be held as anticipating a later inventor who carries out into practice the

generalities of a preceding experimenter, unless a practicable mode of producing the same result has been also disclosed.

REVIEWS OF NEW BOOKS.

The Life of Brigadier-General Sir Samuel Bentham. By his Widow, M. S. Bentham. Longman: 1862. 1 Vol., 8vo.

Memoir of the Life of Sir Marc Isambard Brunel, Civil Engineer. By Richard Beamish, F.R.S. Longman: 1862. 1 Vol., 8vo.

Since the popular success which followed the publication of that vulgar piece of posthumous adulation, Mr Smiles's "Life of Stephenson," had proved the interest that the English middle classes take in the career of worldly success, engineering biography has got quite into vogue. We are not at all certain that the motive spirit, which has made such lives so popular, is any very wide-spread or true, love of science or art, but rather more or less of curiosity to explore, if so they may, the means and modes through which, celebrity, rank, position, and most of all the solid pudding, great wealth, have been obtained by some great names in the profession of the engineer. We suspect that lives written in the same style of those which first ushered in to us, this class of biography, would have found much the same popularity and large class of readers, had they been of "The Successful Merchant"—of Bankers, or Millionaires—or Physicians, who had pocketed their daily basketful of notes in fees, for years and years, and died "eminent."

The truth is, the large unprofessional and unscientific public, is necessarily too imperfectly educated, to be able to form a just judgment upon engineering real eminence, or even to take a real interest in any true discussion of the grounds upon which such an award can be justly given or withheld in the case of any particular individual. It can only judge by results,—wealth and position are two of the most obvious of these; but like many "monuments of engineering skill," as the phrase is, of another sort, these are not always more than "*simulacra*," of the results of true eminence.

Here are two lives, however, which, though neither quite free from the inevitable tendency begotten in an author, by having such an audience to address—the teudency to somewhat over-exalt and *heroise* the individual, are certainly free from adulation.

Both are tributes of affectionate regard: Mr Beamish's that of an old pupil and assistant, to an obviously sincerely honoured engineering leader, — the other, that of the widow, (Lady Bentham,) of the late General, truly deserves that the merits of him who was to her "the chief of men," should be as fully recognised by the world as they are fondly remembered by herself.

Were the real merits of her work far less than they are, sympathy and chivalry might almost forbid a word in its dispraise; and in style, arrangement, and manner, it is entitled to much commendation.

Our Reviews must be too short to enable us to sketch, in outline however slight, the lives of such men as Bentham and Brunel. The former was obviously one of those fervid and creative souls, lodged in a body susceptible of all objective and tactile knowledge, by whom all nature appears to be intuitively grasped, understood, and employed; one of those like Worcester, and a few others, of whom, though on a lower level, it may be said, as of our great poet—

> "Nature led him by the hand,
> Instructed him in all she knew,
> And gave him absolute command."

Such men are not quarrelsome, but they often get involved in quarrels, and Bentham was not exempt, nor indeed was Brunel.

We do not think that these two books, go very far to settle the controversy, (which should never have been posthumously raised,) as to who invented the block machinery. It seems to be pretty plain, however, that the main credit justly belongs to Bruuel, as the man whose mind and labours presided over the progress of the desigu, and finally brought it to complete perfection. The great leading features of *the idea* were probably in Bentham's mind long before he and Brunel ever eame together; and that the actual concrete fashion of the tools owed a good deal to the mechanical resources of the elder Maudslay, there can be scarcely a doubt upon the mind of any mechauic of experience, who compares the block machines, in details of desigu, with some of the oldest machinery that remains, or did some time ago, in the shops at Lambeth, from the days of the fouuder of the house.

Brunel, though contemporary with that race of Titans, who formed the first generation of engineers *as a class* in this country, and of whom the great representatives were Rennie and Telford, can scarcely be reckoned as one of them; he rather belonged to the ranks of the Bramahs and Donkins, the Fareys and Clemonts, and Cleggs—men who stood, as it were, between the former, and men of pure or experimental science.

Brunel was unquestionably greater as a meehanician, than as a civil engineer; it seems a mistake to place his fame mainly upon the basis of the Thames tunnel. In that work, ingenuity and mechanical resouree of a very high order were displayed, hut greatly wasted and misapplied. There would have been no need for them, but for the original mistake of engineering judgment, that started the tunnel at a level too elose to the bed of the Thames. A broader experience, derived from having dealt with the shovel and trowel, upon a much larger scale, than had ever fallen to Brunel's lot, would have induced him to have entered the extremities of his tunnel perhaps half a mile hack from the shore at either side, and to have sunk far beneath the bed under the water column, and so insured a sound and comparatively impervious material, that would have saved the devices of "teredo shields," anxiety and irruptions, and final pushing through, at the eost of the nation. This we know is an opinion in which we are joined by more than one of the civil engineering profession, who, of all others, in this country, are best qualified to pronounce a valid opinion upon the subject.

These both are nice readable books, and to those of our readers who will take them in hand, will afford a great deal of pleasure, and that of Mr Beamish some data for forming their own opinion on that we have just referred to.—Ed.

Professor Rankine's Manuals.—Applied Mechanics; The Steam Engine; Civil Engineering. 3 Vols., Post 8vo. Griffin.

Since the year 1858, Professor Rankine has enriched our professional literature with three distinct volumes, each a large treatise, viz.—His Manuals,—of Applied Mechanics,—of the Steam Engine, and other prime movers,—and of Civil Engineering. Although given the unpretending title of Manuals, these books are, in fact, the most elaborate and systematic works of a rigid character that have yet heen produced on these subjects by a British author. They all present great merits—the stamp of the resolute, mathematical mind, that produced them,—copious information up to the date of publication,—and no ohvious mistakes—none that cau ever mislead reader or learner. They also, however, have some great defects. Rankine's mind, eminently mathematical and rigid in its conceptions, rejoices in symmetry, and philosophic method, aud division of his subject. The result, however, more especially in the "Applied Mechanics," is not always a happy one for his reader, who will often find the treatment of a matter, perhaps one eommon-place enough,—say, for example, "centrifugal force,"—scattered through half a dozen places, and under different great chapters in the volume, so that in place of being able to pick out at a glance, some formula, applicable to the matter he may have in hand, he has to look through half the book, to get at it at last.

This is the more to be regretted, because one of the most valuable uses of these Manuals, to men of sufficient previous knowledge, and actually engaged in professional work or investigation, is, that they are repertories of formulæ, upon one uniform notation, arranged by a man combining that knowledge of practiee, with mathematical power, that has enabled him generally, to produce expressions of great convenience and simplicity of application; and, indeed, a great many formulæ, never hefore printed in a "cut and dry" form, of the greatest and most frequent utility, applicable to structures and machinery, now of every-day occurrence to the engineer, but which are not even noticed in mechanical treatises of 10 or 15 years back may here be found.

A great deal of this evil might even still be remedied, by attaching a thoroughly good *index* to each volume. There is none to the "Applied Mechanics," and that to the "Civil Engineering" is very brief and insufficient. This evil is greatest in the "Applied Mechanics,"—much less in the "Civil Engineering," where a classification, to a great extent arbitrary, enforced as a eousequence better grouping of subjects round separate centres,—and is least of all in the "Treatise on Prime Movers," because in the last it has fortunately happened that a purely rigid and scientific method of division, has corresponded and united itself well, with the older notions of established popular division. In this last respect, we doubt not that even still, to a very large class even of the younger, and not admittedly ill educated, mechauics and engineers, who open Rankiue's treatise for the first time, it will seem rather an odd thing, that water wheels and turbines—water pressure engines and hydraulic presses—air engines and windmills—should form prominent parts of a treatise proclaimed by its title to be mainly one on the "Steam Eugine;" but when the reader shall have mastered some of the hook, he will see that the author is not only scientifically, but systematically right, in grouping all first movers round the one cosmical centre of thermo-dynamics. And just in proportion, as the engineer becomes accustomed to consider every question, of steam or other power that comes before him, in relation to the existing state, of advanced though still very imperfect philosophy of heat, as convertible into dynamic force, will he find his own power over all such questions exalted, and his views enlarged, and given exactitude.

This volume upon the First Movers, we look upon as the very best of the three. It is the first systematic attempt made in English to develope the theory and construction of the steam engine from the thermo-dynamic fulcrum, and must ensure to its author a more than temporary fame.

We cannot avoid finding another fault with these books,—one also traceable, to the mind configuration of their author. He loses sight, it appears to us, too often, of the just limits between that degree and amount of mathematical investigation, which is useful to the man engaged in practice, and is therefore alone proper to any "Manual," and that which belongs to the primary treatise, that takes up its subject at the very base of human knowledge, laying its foundations in all breadth and generality; all fit—proper—indispensable, in the proper place, but here most inconveniently out of place. For example, of what earthly value, in relation to the useful consideration of any practical question, is it to expend nearly two pages (see pp. 51, 52, 53, "Applied Mechanics") in demonstrating in the extreme of generalization, "the finding the centre of gravity of *any* homogeneous body of *any figure whatever*, by the method of co-ordinates. The man who is fit to use Prof. Rankine's book has already learnt this, at school or college it is assumed. Of what use practically, then, are these pages, whipped into a foam with triple integrals, if he has learnt what they mean; and if he has not, in practice we never find bodies to deal with, of *any* form, we always come across them with *some* form, i.e., with a particular form. The space here, and in other like cases, would have been better devoted to giving particular formulæ, for various matters constantly wanted, and even yet not to be found in manuals;—for example, for the position of the centre of gyration in various regular solids, constantly met with in questions of architectural stability, &c., always complicated to get at rapidly, and very sparsely to be found in print anywhere. There is also, perhaps, a *little* "book-making" in these volumes;—for example, the very same problems, treated in the very same way, occur repeated in the different volumes. Thus, in p. 53, "Applied Mechanics," we have "the centre of gravity found by subtraction," and at p. 154 of the "Civil Engineering," we have the same, line for line, and ending in identically the same formula.

$$x_3 = \frac{x_1 W_1 - x_2 W_2}{W_1 - W_2}$$

We admit at once that the author has this valid defence, that his three volumes, are three separate and independent works, and that each must be complete in itself, and apart from the rest. But we entertain a very decided conviction, that if all the elementary mechanics or other similar matter, that is repeated in the two latter treatises, had been cut out, and the books by so much, compressed—reference alone, being made to the places in the "Applied Mechanics"—their value to the engineer and mechanician, would have been greatly enhanced. And as these books are sure to go to new editions, we would even venture to suggest still to Prof. Rankine this process of excision, filling up the voids with investigations on numerous points of practical value, that even yet remain untreated of, or confusedly so, by any author. A plentiful crop may be found.

In conclusion, we are far from intending to speak depreciatingly, by these strictures, of those highly meritorious and valuable works. They add to the well-deserved scientific fame of the author. We do not believe that there is a man south of the Tweed, that possesses the combined qualities,—the hard-headed mathematics—the general practical knowledge, and the "*perfervida vis*," that would have enabled him to produce these books,—creditable to Rankine, and to "old Scotia" that duly honours him.—Ed.

Cotton Cultivation, in its Various Details.—The Barrage of Great Rivers, and Instructions for Irrigating, Embanking, Draining, and Tilling Land in Tropical and other Countries possessing high thermomatic temperatures, especially adapted to the improvement of the Cultural Soils of India. By Joseph Gibbs, Mem. Inst. C.E. London: E. & F. N. Spon, 16 Bucklersbury. 1862. 5 Plates. 248 pp.

On the subject of cotton cultivation, a question of such high importance at the present moment, Mr Gibbs writes, he tells us, from a practical acquaintance with the nature and growth of the cotton plant, extending over a period of more than forty years. The information contained in the small volume before us, is derived from reports made by the author about three years ago, the groundwork for which was furnished by an inspection and survey, made with a view of introducing systems of adequate cultivation and other improvements connected with extensive works of irrigation. We have here a rapid sketch of cotton-yielding countries, more attention being devoted to Egypt and India than to the other such regions. With respect to the former he states, that at least 1,500,000 acres of land now unoccupied could be at once put under crop for cotton. As Egypt is only eight days' journey from London, this country strongly deserves the attention of our capitalists, seeing that the cotton fields could, from the nature of the climate, be placed under the supervision of Europeans. Then we have observations upon the proper mode of growing cotton, the irrigation of lands, &c. Altogether, it is a book which deserves the attention of those who contemplate the cultivation of cotton.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

PERFORATING SHIPS' ARMOUR.

Sir,—I beg to forward by post one of the many plates upon which I experimented two years ago, and drawings of which I forwarded, with description, to the War Office, while the late Lord Herbert was minister (*that is, of the gun and boat*); but the Select Committee of Woolwich did not think fit to give it a trial.

It is in consequence of the article in your number of April that I refer to the matter, and beg your opinion on the question, as you see by the plate forwarded what can be done by a small gun (a model), *with the greatest safety and certainty*, I can assure you, as I myself experimented for *twelve months consecutively;* and you will perceive that I could penetrate a much greater or thicker plate were it embedded against wood, as it would in that case be solid, whereas the plate sent was simply placed in a groove, the whole surface left unsupported.

And I could, with the greatest ease, sink any size of ship, iron-plated or not, as long as I could remain alongside. If you would like to see the model you can, but I have not secured it, neither do I intend to do so, as it is of no use to any one but the Government. Mr Whitworth was very much interested in it. All this may be done without air chambers, or any thing, but a simple mechanical arrangement for loading and firing; and the recoil is taken up on india rubber rings, but is so small as scarcely to be taken notice of. The shot is a conical steel triangular cone.—Yours very truly,

Cardiff, May 12, 1862. Matthew Jones.

[We have not deemed it necessary to give our correspondent's sketch, as it, in fact, contains no details, and his general arrangements are sufficiently described in his letter. The perforated plate sent to us is rather under 2-10ths of an inch in thickness, and of iron of good quality.

The diameter of bolt shot through it, does not appear, upon measurement of the aperture, to have exceeded by much, half an inch in diameter. The full-sized sketch sent us of the model gun, stated to have thrown the bolt, shows a calibre of 5-8ths of an inch.

In either case, there is nothing new or remarkable in the work performed. Five or six years since, experiments were conducted at the instance of Sir Jno. F. Burgoyne, Insp. Gen. of Fortifications, to determine the *minimum* thickness of iron plate that was proof against the ordinary lead minie rifle bullet—the object being to employ the lightest possible iron or steel plates for "flying saps" in siege operations. The results showed that at even two hundred yards a man was not quite safe from such missiles behind any wrought iron plate thinner than a quarter of an inch; and even steel plates of 3-16ths inches thick were pierced. The intervention of several feet of water in advance of the plate would have made a serious difference; but a plate of 2-10ths inch thick could be perforated by an ordinary lead rifle bullet, after having passed through some feet of water. What was the precise form of our correspondent's bullet we do not gather from his expression, "a triangular cone;" he probably means a cone whose angle is 120°; nor does he give its weight or material; the charge, he says, was 1¼ drachms of powder. We think Mr Jones' arrangement better than Mr Siemen's, so far as the permitting the recoil of the under water gun through a stuffing box in the ship's side is concerned; but, in all other respects, his notions are liable to precisely the same physical objections that we

have shown apply to Mr Page's plan, and from which Mr Siemen's arrangement proposes to escape.—Ed.]

MACHINE FOR CUTTING OVALS.

Sir,—In your June part, a machine for cutting ovals is described as invented by Mr Robert McAllister, of Dublin. I have no doubt he has independently invented this combination; but it is one by no means new, having been proposed several years since by Mr Jopling, and many of its curious properties pointed out in the periodical literature of the time.

The curves traced are not geometrically ellipses, nor can ever be so while the longer of the two rods is of finite length. Moreover, the two opposite ends of the closed curve, through which the greater axis passes, are not alike, so that the instrument can never, in fact, be employed as an elliptograph. Mr Jopling showed that it is capable of tracing very singular and often beautiful curves of *contrary flexure;* and in the hands of the porcelain manufacturer it is capable of important uses, in tracing ovals of great beauty, to be combined in forms of vases, tazzae, etc.—Your obedient,

R. R.

A SIMPLE INSTRUMENT FOR DRAWING VOLUTES.

Sir,—In a conspicuous position of the part in the Great Exhibition appropriated to philosophical instruments, may be seen a specimen of Johnson's volutor—an instrument, as the name suggests, by which volutes may be delineated. That it is of considerable utility may fairly be allowed, but it is too cumbrous and restricted in its application to be of very great use, and thus to be set down as a notable invention.

I will now describe a simple instrument, which could be carried in the pocket, by means of which volutes of any kind could readily be drawn, and this with the minutest accuracy. A metallic and circular belt, some three or four inches in diameter, should be provided, in the centre of which, and extending a few inches upwards, and then curving down to the external part of the belt, to which it should firmly be attached, one end of a rigid bar should be placed, which should contain a moveable piece, to be tightened or rendered loose by means of a screw, which moveable piece is to hold one extremity of as homogeneous a watch-spring as can be obtained, the other end of which, the spring being curved inside the belt, should, without its natural bend being altered, a very important point, as may at once be seen, be brought through an aperture in the belt, to be made for this purpose, and delicately but firmly pressed by a screw, which could work in a small bearing clamped to the belt at this part, or here permanently fixed.

The bar should extend upwards to allow of the requisite motion of the hand, and the curve should be described by means of an instrument having a groove, which should, of course, be fitted into the several parts of the spring. It is evident that the curve could not be commenced precisely from its centre, which circumstance, however, could not be of much importance. The centre should be the approximative point, and the deficiency could, in every case, very accurately be supplied. Parallel volutes, or those in which the distances of the spirals proportionately increase, could be delineated with this instrument; and besides this, by sufficiently drawing out the spring any curve could be obtained, and afterwards immediately be got, if marks were made upon it. The *principle* of the instrument or apparatus is the following physical law: That the distances asunder of the several parts of any curved, uniform, and homogeneous substance, are inversely in proportion to their tension, or, which is the same thing, less according to its greatness, and *vice versa.*—I am, Sir, yours, etc.,

May 12, 1862. J. A. Davies.

HAYES' STEAM GENERATOR.

Sir,—Your Correspondent, C. F. Hayes, of the Royal Small-arms Factory, is perhaps unaware that he is not the first experimentalist who has proposed that particular mode of generating steam, mentioned in your last number; and provided water could at all times be obtained free from saline and calcareous deposits, the proposed plan would no doubt be desirable for many reasons. But unfortunately that is *the* difficulty, and a remedy for which Mr Hayes does not seem to have provided. I very much fear that his small bore pipe has even by this time become very much smaller in its interior capacity.

Perhaps Mr Hayes will point to surface condensation as the remedy, and in that respect he is perfectly right, as far as it goes; but then his mode of generating steam is rendered inapplicable to many useful purposes, such as locomotion, both on rail and road, agricultural engines, &c., &c.

Perhaps Mr Hayes will, from time to time, give us the benefit of his experience with his generator, as I quite agree with him that the time has arrived when some plan should be provided to remedy the existing state of things, both as regards safety and economy in the production of steam, neither of which do any credit to "applied science" in the year 1862. I do not clearly see how his cylinder ¾ thick, could have been burst with only 48lbs. pressure, unless there was a considerable flaw in the casting.

Tavistock, 6th June, 1862. W. C. Hare.

GENERATING STEAM.

Sir,—In the *Practical Mechanic's Journal* for this month I see a description of a new steam generator by Mr Hayes, of Enfield. As I also, in 1853, designed a steam generator, I should, as an old contributor, be much obliged by the insertion of a short description of it, if not intruding on your space.

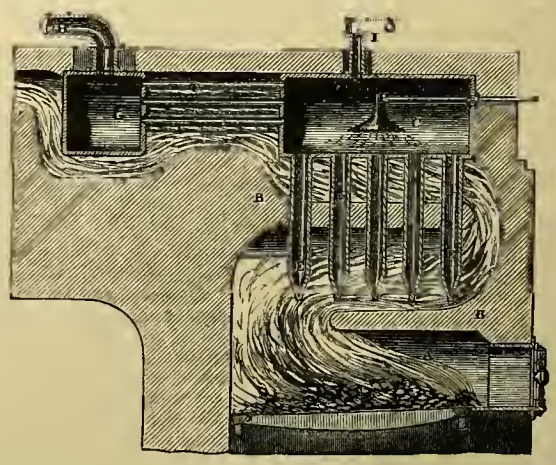
It is well known that the injection of cold water upon hot plates, or flat-ended tubes, will not produce *quick evaporation* if the said plates or tube-ends are above 206° temperature. Now, my object was to produce quick evaporation from a tube at any temperature, even up to white heat. This I attained by flattening the tube just at the end, as shewn in the sketch, thus producing a flat-coned end instead of a plain flat-bottomed tube. The form of the tube is well exhibited by taking a piece of tubing and pinching one end in a vice, and then welding up the flat-cone or wedge shaped end thus produced.

Now, I found that by a tube of this form the following effects were produced:—1st, The tube evaporated the water injected instantaneously, even at a white heat. 2nd, By the peculiarly sharp angled bottom, the revolution of the injection water was entirely prevented. 3rd, This tube evaporated three times the quantity of water which an equal fire surface on the *boiler plan* did.

By many subsequent trials, I was convinced that this form of tube-end entirely prevented the drawbacks of Boutigny's spheroidal evaporation, which is directly opposed to quick evaporation.

The sketch which I send shews the arrangement precisely as I shewed it in 1855, to Mr England, of the Hatcham Iron Works; therefore, I trust Mr Hayes will acquit me of any intention to deprive him of the credit due to him.

The accompanying engraving represents a vertical section of the arrangement. The furnace, A, has extending backwards a bridge of



brickwork or fire-clay, B, and above this is a second one which extends towards the front of the external brickwork. The flame from the burning fuel circulates through the chamber formed by these overbanging

parts, and passes beneath the generator and superheating apparatus away to the chimney. The steam generator, C, is a cylindrical vessel which is supplied with water from a contiguous reservoir, the water in which is kept under pressure by means of an air vessel. The water flows by the pipe, F, through the rose bead, which distributes it to the tubes, E. From the generator the steam passes through the superheating tubes, F, to the steam chamber, G, whence it passes off by the pipe, H, to the engine. The generator, C, is provided with a a safety valve, I, of the ordinary kind.

As I have before this given some inventions to the public, I hope that this which I now send may be acceptable, as I know it would be useful and cheap, and, like Mr Hayes's, free from danger.—I am, Sir, your obedient servant,

Rochester, June 2, 1862. THOS. E. MERRITT.

MECHANIC'S LIBRARY.

Animals, Uses of, in relation to the Industry of Man, 1s 6d. Lankester.
Art, Ornamental, in the International Exhibition, 1s, sewed. Dresser.
Bleachers, Hints to, by a Working Man, 18mo, 2s 6d, cloth.
Chemistry of Soils, Handy Book on the, post 8vo, 4s 6d. Scoffern.
Cocoa, Growth, Culture, and Manufacture, 12mo, 1s.
Design, Art of Decorative, 8vo, 21s, cloth. Dresser.
Drawing-Book for Young Children, new edition, 16mo, 3s 6d, cloth.
Educator, Popular, new edition, 4to, 5s, cloth.
Flower Garden and Greenhouse, Handbook to the, 5s 6d, cloth. Glenny.
Fortification, Treatise on, 4to, 31s 6d, cloth. Lendy.
Gas Consumer's Manual, 3d edition, 12mo, 2s 6d. Marriott.
Geometry, On the Analytic, of Three Dimensions, 8vo, 12s, cloth. Salmon.
Mathematics, Solutions of Questions in Mixed, 8vo, 3s 6d. Fowler,
Mechanics, Manual of, 6th edition, fcap. 8vo, 2s, cl. Galbraith and Haughton.
Mineral Agents, Handbook for, Mahon's, 4s, cl. Edited by Haughton and Scott.
Ready Reckoner, Land Measurer's, new edition, 8vo, 5s 6d. Turner.
Trigonometry, Hunter's Plane, School Series, 1s; Key, 9d. Gleig.

ON THE PROTECTION OF THE BOTTOMS OF IRON SHIPS.

An Abstract of a Paper read at the Royal United Service Institution, with remarks thereon by ROBT. MALLET, ESQ., C.E., F.R.S.

MR GRANTHAM.—In my own work on Iron Ships, written about twenty years ago, and of which a second edition appeared in 1858, the following remarks occur:—

"There is one source of risk to which iron ships are more liable than timber-built ships; I allude to the effect of a blow from a hard and pointed substance, such as the fluke of an anchor or a sharp rock. These have been found to penetrate the iron plates more freely than through the planks of a timber ship, supported as they are by the ribs, which form almost a solid bed under them." Again, "The fact that iron vessels become coated in tropical climates with shells and weeds, has operated considerably against them. . . . . That the objection exists cannot be denied, and it constitutes at present the most annoying circumstance connected with iron ships."

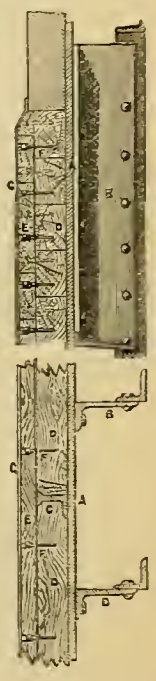
In the first case, to meet the disadvantage of having the plates pierced, we say, multiply the bulkheads as much as possible, and make them strong enough; and we also reccommend those who navigate iron ships not to go upon rocks!

In the second, we say, apply such composition as experience shows will keep longest clean; and when your ship goes to a tropical climate, get home as quick as you can, and put her in dock, and clean her; but we are obliged to admit that if iron ships are to become universal they will get on rocks, and they must also be detained in climates where they will become foul.

It will be readily supposed that those practical men who have long been engaged in iron ship-building have given these questions their anxious attention; we have long been aware that copper sheathing is the only permanent remedy known for resisting the tendency of a ship to foul; and in proposing a system by which this may be safely applied to an iron ship, a practical method of enabling them to resist concussions from hard substances has also suggested itself. Many attempts have been made to attach copper direct to the plates by some principle of adhesion, and one of these will, I believe, be exhibited to you to-night. I tried many of these some years ago, but abaudoned them all; I then suggested the plan now before you. One man actually sheathed an iron ship formerly belonging to our Government with planks, and secured them by means of an immense number of bolts put through the plates, over this he placed copper, and the vessel had made two voyages into the Pacific when I last heard of her; but as the system of bolting was in itself bad, I cannot suppose that it could have any favourable result.

I avoid specifying or giving more than a general opinion on the various compositions that are sold as remedies for this great evil, the fullest opportunities have now for some years been given them, and let the experience thus gained speak for itself. Upwards of twenty years ago, when the evil of fouling began to be sensibly felt, iron-ship builders used a composition that was considered efficacious, but which it was soon found was very partially successful. Some that I have seen since, and which have been claimed as new, were of a similar character. I may say generally that they cannot be substitutes for copper, because their action, if any, differs so much from it; none of them present a surface that is continually changing by the process of oxidation. Some of them present a smooth surface, and this naturally will keep clean longer than a rougher surface; but none of them, so far as I know, have been able to resist, for any length of time the slow encroachments of that animal and vegetable life that arrests the career of the most powerful ships.

Remedies for this evil are required for the merchant service, but they appear to be essential in the Navy. For a moment consider the case of the "*Warrior*," in herself a great success; in such a ship a high velocity is considered an essential qualification, and whatever advantages iron may possess, they must all be given up if the adoption of it is to result in a dimunition of speed. About £80,000 has been spent on her machinery; a large amount of space has been sacrificed to it, and the coals, of which about 150 tons per diem is required to drive her at full speed; and what will be the result? Send her into the Mediterranean, the Gulf of Mexico, or to India, and, if left there, in a short time her speed will be seriously reduced, and in six months her fourteen-knot speed will probably be ten, and in twelve months much less — probably seven would be her best speed. It is true when she gets into this state she may be cleaned if you can get her into a graving dock, perhaps 1,000 miles from her station, or she may, if she can find it, be forced up into a fresh water river, and there after lying some time, be partially cleaned by the death of the weeds and animalculæ, whose natural element is salt water, and which cannot live in fresh. And then what follows? the ship is no sooner at sea again than the same process commences, only to be removed by resorting to a repetition of the same means. I suppose, however, that no graving docks out of Europe would receive our heavily-plated ships.



A Section of Side Plates.
B Inside Frames.
C Outside Frames.
D Inner Planks.
E Outer Planks.
F Brass Screw Bolts.
G Copper Sheathing.

The case may be illustrated by well-known facts that occur in this climate, where shells seldom attach themselves, but which is due to weeds only, with a certain amount of roughness that rises in salt water upon ordinary paint. Every iron vessel for the first month after leaving the graving dock and having the plates cleaned, goes better than she does subsequently. This has been accurately tested by the new vessels belonging to the City of Dublin Steam Packet Company, which carry the mails from Holyhead to Kingstown. In the summer time, in about two months after leaving the graving dock, their speed uniformly falls off so as to increase the length of the passage ten to fifteen minutes, or equal to about half a mile to one mile an hour. After the first two or three months the retardiug process in this country goes on slowly, but where shells attach themselves the contrary is the case.

Having, I trust, shown some grounds for supposing that copper sheathing would be desirable if it could be applied, I now ask your attention to the drawings, and you will see that while the first object sought was a remedy for fouliug, the same system supplies a very effectual protection against concussious, an advantage that must to some extent satisfy the requirments even of the strongest opponents to iron ships for the Navy. It will be seen that I commence by attaching frames to the outside of the vessel to run up to the light water-line, or to the armour-plates in large plate-clad ships. These frames are rolled like common angle-iron, except that the outside edge is made of a wedge form, or flanged, as shown in the drawings; they are riveted to the ship in the usual manner. Between these is driven a timber planking, which becomes firmly wedged; and being set in with suitable compositions, and then caulked, forms a solid bed. This would be made from refuse timber cut from the wood used in other parts of the ship. The whole heiug then dubbed even with the ribs, and again coated, another sheathing is attached by brass screws. I have made the inner one for large ships four inches thick, and the outer one two inches. the copper sheathing is then attached in the usual way.

Thus a firm substantial bed is prepared for the copper, all metallic contact is avoided, and great additional protection is given to the bottom of the vessel. I will endeavour now to anticipate and reply to the objections that may be used against this system.

1st. That it will be expensive;
2nd. That it will add to the weight of the vessel;
3rd. That it will injure the iron plates;
4th. That the timber work will become loose when the vessel strains.

In discussing all these I take the "*Warrior*" as the vessel to which allusions and comparisons will be made, being most deservedly greatly in advance of all other ships in public opinion,

1st. As regards the expense. I estimate the timber, labour, screws, and coating at less than £4,000, if put on when the ship is building, on a ship valued at £350,000. The copper is not included. I claim against this, in making a ship of equal safety, a saving of 200 tons of iron, which at £20 per ton, equals £4,000. But by far the largest set-off is to be found in the saving of steam-power, and for foreign service, I set this down in the "*Warrior*" at 500 horses, upon the average of a three years' cruise in warm climates, or 200 horses in the home service; or what is more important still, that the vessel shall, if kept clean, at all times maintain her proper speed.

2nd. If the comparison is to be fairly carried out, the increase of weight will be very little. I claim a saving of 200 tons of iron, and the timber will weigh 280 tons, a difference of 80 tons in a vessel displacing 8,000 to 9,000 tons.

3rd. I deny that it will injure the plates; on the contrary, I assert that it will be a great protection to them, for being once well painted, the sheathing will effectually protect the paint, and while this remains unbroken, there is no fear of corrosion. There being no bolts to work loose, and no metallic contact, there is abundant evidence to show that the plates of iron ships, under such circumstances, will be entirely free from injury.

I have heard it asserted that injury to the plates may go on unobserved beneath the woodwork. In the first place, the probability of such injury is very remote; at the worst the water can only penetrate to the plates and there remain quiet, and even there the coating will arrest its progress; but supposing further the plates to have no protection, what is to be apprehended? the water is at once deprived of its oxygen, an infinitely small amount of corrosion takes place, and then all further mischief ceases.

4th. The last objection which I have anticipated is, that the timber will work loose.

I do not know whether the lateral motion of the "*Warrior*" has been ascertained; but I have assumed it to be four inches in her entire length, in which case I make the average opening at the outer edge of each seam in the lengthways of the ship to be about the 17,000th part of an inch, or the 70th part of the thickness of an ordinary sheet of writing-paper, and the inner edge of the seam to be absolutely nothing but what may be allowed for in the positive direct stretching of the plate between each frame at every motion of the ship.

No one for a moment will doubt that the elasticity of the timber will much more than compensate for these small movements; and it may here be well to consider how this principle acts in every timber ship, and is essential to its safety—its very existence depends on the power in the timber and oakum of its seams to expand and contract; for, suppose they had not that property, but in that respect were like lead, which can be compressed, but will not expand again, having little or no elasticity, it is probable such a ship would founder in the first gale. May I not claim in this argument some benefit from a principle which is the sole dependence of every ship made of timber?

I have now very briefly to ask your attention to this system in its action, as a buffer in case of collision with hard bodies. That it will so act is self-evident: externally it will endure whatever ordinary planks will, internally it will tend to spread the effect of the blow over a larger space; it will likewise interpose an elastic substance, which, in itself, will materially lessen the effect of the direct contact with a rock or other hard body.

Mr R. Mallet.—The honour of having been asked to make a few remarks upon the paper which has just been read, has, no doubt, been done me from the fact that several years since I myself made some researches on the subject of the corrosion and the fouling of iron, which have been published in four different Reports by the British Association for the Advancement of Science in the years 1839-41-43 and 49; and although not an iron-ship builder, yet having, as a civil and mechanical engineer, and for several years the active partner of an engineering firm, been familiar all my life with the practical applications of iron, and especially with its uses in the form of structural works of plate and angle iron, &c., &c., often as much exposed to corrosion as iron ships, so I am enabled to form a practical judgment on the subject brought to-night before the Royal United Service Institution. The importance of the subject itself, as Mr Grantham has stated, I think it would be difficult to overrate; for highly important as the corrosion and fouling of iron ships has been at all times to the mercantile marine in a money sense, it becomes of far more vital importance now that iron ships are certain to be applied for war purposes; for if it be a fact that a war ship sent to sea, after some six or eight weeks loses a mile an hour of her speed from alteration of the surface of her immense hull, or, as we may call it, from fouling,—if a vessel so circumstanced be caught by a clean ship of the enemy that has got the mile an hour still, the former is taken at a disadvantage which nothing can make up for, and so the mere state of her surface determines whether she can keep the seas or not. Hence this question of fouling has become a national one.

There are three aspects, or three directions in which perhaps it will be well to make a few remarks in opening the discussion on this paper. The subject has its bearings of a directly chemical or physical character as respects corrosion and as respects fouling, and it has a practical character as regards construction, that is to say, in what way, and to what extent principles determined by the chemist and physicist, can be practically carried out by the shipbuilder.

As respects the first, it will be perhaps advantageous if I very briefly lead back the attention of those who may not perhaps at all have considered the effects of corrosion and fouling, to a few of the fundamental facts of the subject, ascertained by myself principally, I may say; indeed, I hope I shall not be guilty of any immodesty were I to say altogether; for, so far as my knowledge goes, those four reports of mine up to this present embrace almost the whole of the scientific literature that exists on the subject of the corrosion and fouling of iron ships, and of iron generally.

Iron is only acted upon in the way of corrosion by water, whether it be fresh or salt, that also contains air in combination. All the water we find in nature contains a certain quantity of dissolved air, and the air it does contain—combined in the same way that we find the carbonic acid is in a bottle of soda-water—possesses a larger proportion of oxygen than exists in the air we breathe, *i.e.*, in the atmosphere. If a piece of iron be placed in water from which this combined air has been exhausted, whether the water be salt or fresh, at the ordinary temperature, no corrosion takes place; but if it be exposed to the action of water with this combined air, or air and water together in any other way, or to each alternately, then corrosion does take place; and up to the present hour science has failed to devise any means by which that corrosive action shall be completely arrested. All the various devices of coating with other metals such as with zinc, usually called galvanising, are found to be perfectly nugatory, under the above circumstances of exposure and constant moisture. Even in perfectly pure fresh water, galvanising—coating the surface with zinc—is a palliative of corrosion and no more. In sea water it is entirely useless, and as applied to iron ships it would be absolutely hurtful, because, independent of any ill effects upon the toughness of the iron, one of the effects of any partial removal of the thin surface coating of zinc is that a thin coating of carbonate of lime is rapidly deposited upon that which remains, and upon that excessively thin bed of lime fouling takes place immediately—plants and animals readily attach themselves to it.

I do not despair, however, of science hereafter being enabled to make an iron ship as invulnerable to corrosion as if it were a piece of platina. I may just illustrate the conceivability of this by repeating a very simple experiment, first due to Professsr Schoenbein of Basle, the discoverer of what is called the passivity of iron. Here are two pieces of common sheet iron, and a piece of platina. Here is an acid which is capable of rapidly corroding and even dissolving a piece of iron in its ordinary condition when plunged in it directly: this acid does not act on platina at all. If, however, in place of putting the piece of iron into the acid directly, in which case it would instantly begin to be acted upon, I touch it first with the piece of platina, and immerse the two together, and then withdraw the platina, the iron remains in the acid in a perfectly passive condition; the acid, which is capable of dissolving the whole piece of iron in a very few minutes, does not now act upon it at all, it remains as passive and incorrodible as does the platina itself. Further, if I now take another piece of iron which has not been touched by the platina, and touch it with the piece which has been already touched and immersed, it will be found that the latter piece of iron is now in the condition to bring another piece of iron into the same condition with itself, and so in its turn this second piece would not be acted upon; and so we might go on for ever. But if I put a piece of iron which has not been touched by the platina, or by another piece of iron so touched, into the acid, it will be acted upon directly; and if I touch it now with the platina while in the acid or withdrawn from it, this will not now prevent its being corroded, nor arrest the corrosion that has commenced. This little experiment suffices to show that iron, one of the most singular bodies amongst all the elements with which we are acquainted, marvellously endowed with properties fitting it for the uses of man, has yet unseen and undiscovered properties, such as those Bacon talked of long ago, when he said nature still containeth secrets more marvellous and potent than the wit of man hath yet conceived, much less discovered. It indicates the possibility that iron still contains secrets within it that may enable it to be made into an iron ship incorrodible in water, although without any external protection whatever. Indeed, did the passivity of iron extend to the chlorine compounds, as it does so far as is yet known only to the oxygen compounds, the end

might be at once accomplished. By experiments carried on in Kingstown Harbour, and in various other places, upon the actual rate of corrosion of exposed surfaces, say a square foot of iron, for lengthened periods of three or four years, I have ascertained the rate of corrosion for iron, cast, wrought, and steel, from various makers, of different qualities, in various conditions, and in various waters, such as fresh and salt, and each both pure and foul by sewage, &c.; and I may state as one result of these experiments that the rate of corrosion for wrought iron in clear sea water—I am now talking of average iron, such as is used for ordinary ship building—would be such that, corroded on one surface only, six-tenths of an inch in depth would be taken away in a century. That is the rate at which an iron ship in sea water will corrode if not protected by paint or anything else. If protected by certain varnishes or coatiugs, the progress of corrosion may be enormously retarded. That is to say, if the plates were six-tenths of an inch in thickness, and acted upon on one side only, the iron would be all gone in a century. This supposes that corrosion takes place uniformly and alike all over the surface; but that condition does not hold as respects the surface of an iron ship; there are parts where the action is much more rapid than at others, and round the rivet seams corrosion takes place, *cæteris paribus*, much more rapidly than anywhere else, from the rivets being harder owing to the process of closing, than the rest of the plate, and hence slightly electro-negative to the plates of the ship, or in the like relation to them as a piece of copper. It was long ago ascertained by Professor Edmund Davy, nephew of the celebrated Sir Humphrey, that iron possesses the property of being protected, by zinc attached to it in mass, iu the same way that Sir Humphrey Davy showed years before that copper sheathing could be protected by zinc protectors. I ascertained that the hull of an iron ship could be protected to a very great extent from that universal corrosion which takes place, by the attachment in mass of a surface of zinc, only extending to $\frac{1}{120}$th of surface of the exposed iron. But that will not stop such corrosion of an iron ship as goes on close to where the wash of the paddle-wheels affects her sides, nor near the bows, and other parts where the air and water are constantly agitated and renewed iu contact with the iron, and fresh surfaces of the latter constantly exposed by the washing away of the rust already formed. The moment you produce protection with zinc, however, you get a deposit upon the surface of the iron of carbonate of lime in crystals—calcspar, in fact, in the ordinary rhombic form—produced by decomposition of the salts of lime in the sea water; and so the groundwork for fouling is at once laid, and it increases then at an enormous rate. I further ascertained that if the rate of corrosion of iron iu an iron ship—the iron plates alone being exposed to sea water, be represented by a number equal to 8—then, if exposed in contact with copper, such as copper sheathing, in the proportion of two to three, that is to say, three square feet of iron to two square feet of copper, in that case the rate of corrosion will be increased in the ratio of 11 to 8, the iron corroding alone at the rate of 8, but at the increased rate of 11 if it be in contact with two-thirds of its own surface of copper. But I ascertained a further fact, which is an important one. Ordinary gun-metal, such as is used for the screws of our propellers (alloys of copper with 8, 10, or 12 per cent. of tin) possesses the power of increasing the corrosion of wrought iron enormously more than pure copper itself, so much so, that if the three square feet of iron we were talking of were in contact with two square feet of gun-metal. the rate of corrosion is increased, not from 8 up to 11, but from 8 to 19. In connection with this fact I may observe that I have seen it stated that a great number of the iron ships now being sent to sea, or in preparation for sea, by the Admiralty are fitted with gun-metal propellers. If such be the fact, anything more injudicious or more uselessly destructive to the iron of an iron ship can scarcely be conceived, nor anything more uuuecessary. Every marine-engine maker knows perfectly well that cast-iron propellers, or wrought-iron propellers may be made perfectly safe, weight for weight, with those of gun-metal. It is hard to see, therefore, why this material, that costs about 2*s* a pound, should continue to be used, where a material which costs about 3½*d* or 4*d* a pound ought to be used instead; the dearer material being positively mischievous to the iron ship as well as to the screw-bearings, &c. I also ascertained that among the couceivable alloys of copper and zinc with which an irou ship might be covered, was one closely approaching to the alloy known as Muntz's metal, but not identical with it. This was an alloy of four atoms of copper to one of zinc, very nearly the composition formerly known as Dutch brass. It is a remarkable fact that the galvanic action on iron in sea water of this particular alloy is almost *nil*. A vessel coated with such an alloy, the surfaces being in the proportion of 3 to 2 as before, the rate of corrosion of the iron is only accelerated in the proportion of 9½ to 8; the iron is hence very little worse than if not in contact with any electro-negative metal at all. So far as the chemical properties of this alloy are concerned, it might be applied directly, therefore, to sheathing an irou ship; but any attempt at coating an iron ship directly with any metal sheathing is quite out of the question. The mechanical difficulties are insuperable; you cannot attach sheathing firmly to the skin of an iron ship iu any way, but you injure the strength and diminish the safety of the ship enormously. There is another class of facts to which I may briefly refer. The rate of corrosion of iron in sea water greatly depends, other things being the same, upon the quality of the iron; I do not mean the quality of the iron in the sense in which we usually apply the word in the market, namely, the very best iron as regards toughness and strength. Here is a fact, ascertained by several years' exposure of large surfaces, and therefore reliable,—that an equal surface of the hull of a ship built of the common plates known in commerce as "boat plates"—the worst class, in fact, of Staffordshire or Yorkshire plates—will corrode in a given time at the rate of 36, while an equal surface if made of the very best plates of cold-blast South Wales iron will corrode only at the rate of about 8½ to 9; and that if the plates are of very highly-wrought iron worked over and over again, such as faggoted scraped iron when rolled into plates, or Low Moor or Bowling irou, then the rate of corrosion will be only 2½ in the same time for equal surfaces. It is hence apparent how much is lost iu durability and in freedom from corrosion and fouling as well as in strength, by the too prevalent use of inferior qualities of iron for shipbuilding. I will now drop the question of corrosion and come to that of fouling. The two, however, are inseparably connected, and for this reason, that if it were possible to get the hull of an iron ship into a condition that it would not corrode at all, there would no longer be any difficulty abont preventing it from fouling at all. It was years ago ascertained by James Prinsep, of the Indian Service, and attached to the Calcutta mint. He ascertained the fact that, if you oil or coat a surface of iron with any greasy varnish, or with any shiny material, such as the native Sylhet varnish of India, or even with common drying oil—so long as a vestige of such a coatiug remains upon the surface, none of the lower forms of animal life attach themselves to it. The cause is apparently a purely mechanical one. The surface is so smooth that the animal is not able to attach himself—the smallest wash of the water washes him off. But whatever be the cause, if we could get that sort of greasy material or any varnish to stick to iron permanently, we could prevent the fouling; but no coating has ever yet becu devised that will accomplish this. Innumerable coating compositions have been proposed. I have myself a list, made for me some months ago, of about seventy patents that have been taken out, since the date of my British Association Report of 1843, of different nostrums for preventing the fouling of iron ships. They are all failures; not one of them has answered, not even excluding my own, which was the origin, and predecessor of them all. And I may mention further; there is not one of these patent compositions that is not simply ringing the changes upon what was originally proposed by myself. In 1843 Mr William Fairbairn and I patented a mode of preventing the fouling of iron ships. It was based on lengthened observations I had made as to what were the conditions under which animal and vegetable life attach themselves to iron ships, and what were the conditions that would he disadvantageous to both. My researches were conducted upon many of the lower forms of marine animal life; and I was then enabled, by living on the seashore, to carry them out with the necessary accuracy and facility. I experimented on oysters, sea-anemones, mytilus, balanus, lepas, patella, and several other forms of lower marine life, besides vegetable marine forms—such as fuci, confervæ, byssus, &c. I found this curious fact with respect to these lower molluscous animals: that the soluble poisons, provided these creatures are very slowly accustomed to them, do uot seem in any scrions degree to affect them. I had some of these animals in glass jars for two or three years, with constantly renewed aeration of the sea water. At stated intervals a few drops of some soluble poison—for example, sulphate of copper—were dropped into some of the jars. At last I had oysters living in apparent health in a solution of sulphate of copper, which, if any one of us were to drink half an inch deep out of the glass, would have poisoned us, or produced vomiting. The animals themselves were so impregnated with copper that, if you thrust a commou peuknife into one of them, and let it remaiu in his body a short time, the blade came out coated with copper. The oysters themselves did not seem particularly annoyed for lengthened periods, provided the process was conducted exceedingly gradually; they all, however, contracted iu bulk, and died wheu the poison reached a certain amount of concentration. If you were to put an ordinary oyster, not accustomed to these bad habits of poisonous diam-drinking, suddenly into the same coppery water, it would die within a very few hours. The facts are analogous with the well-known powers of passive endurance of all the lower forms of life. The same, however, does not hold with poisons of an insoluble, or, rather, difficultly soluble, character, put in a solid but finely-divided state in coutact with such animals. An oyster or sea-anemone put into a jar of sea water, into which were dropped a very few grains in fine *powder* of—say, realgar or sulphuret of arsenic, and stirred up, is sure to kill the animal; it could not exist under such circumstances many hours. The solid grains of the iusoluble poison appear to be brought into the fine cells of the branchiæ—such as the beard of the oyster—and he has not the power of eliminating them, and the auimal is poisoned, by the irritating contact probably. Whether that is the explauation, I am not naturalist enough to kuow; but I can vouch for the facts. My uethod. which Fairbairn and I pateuted, was based upon these. It consisted in

coating the iron plates, after they had been thoroughly well heated by lighting coke fires under the bottom of the ship in dock, with boiled coal-tar chiefly, and on that was laid a slowly soluble varnish, a sort of metallic soap, containing difficultly-soluble poisonous matter. It was mainly formed of common bright varnish, coal-pitch, soft soap, and the poisonous matters, several of which were proposed; but the one which I advised as best was "realgar," or sulphuret of arsenic. I went to Liverpool to see the iron-ship builders, and, amongst others, the late Mr Laird, with the view to get them to adopt my method. At that time the ship-builders, one and all, said, "Oh, iron ships do not foul at all, and as to corrosion they will last for ever; but in any case" (one of them told me) "we do not want your method, we have some of our own that will do as well." A few months afterwards I found that a vessel had actually been coated at Liverpool. I succeeded in obtaining some of the coating, and I found that it consisted of bright varnish, tallow, flowers of sulphur, and white arsenic—that is to say, it was precisely the four ingredients of which my patent consisted, only combined in another shape. All similar compositions that are now used, and which have the best reputation, consist of partially insoluble salts, either of copper or arsenic, or of both, mixed generally with a lot of nostrums which are of no use whatever. They are at best mere palliatives, for it is a fact that they all do foul, after a time longer or shorter, over the whole surface. The stuff gets stripped off by the washing of the water, or accidentally, and as soon as that takes place the remaining portion begins to get coated with a thin film of carbonate of lime, deposited from the lime in the sea water; and the moment that deposit takes place the surface becomes a fit nidus for the lower marine animals and vegetables, and then fouling goes on. We therefore come to this conclusion, that some better method is wanted for the protection of iron ships than is afforded by any chemico-mechanical method of coating yet proposed. Now, I would make one or two remarks of a purely practical character upon what Mr Grantham has brought before us. To prevent any misapprehension, I wish to state that I have no personal interest in Mr Grantham or his patent, direct or indirect; I stand here by invitation of this body, to which I have the honour to belong, simply to state, for the information of those around me and for the good of our common fatherland, whatever knowledge I have acquired applicable to the subject. Mr Grantham's method amounts to this; we must all admit that if we could put an iron ship into a water-tight wooden saucer of her own form, and let her go to sea in that wooden casing, corrosion or fouling could not take place on her bottom; whatever happened must happen to the wood. The question therefore is, can you make a water-tight wooden saucer round an iron ship? Mr Grantham proposes to do so, and, for anything I see to the contrary, I think he can succeed. His method is this: he spaces over the skin of the ship a number of dovetailed ribs of iron riveted to the skin, and between these he drives in, and caulks water-tight pieces of wood; the dovetails hold them on without piercing the skin anywhere, and the caulking makes the wood skin water-tight; over all this he places what other metallic sheathing seems good to him. I conceive there can be no possible doubt that pieces of wood may be driven into dovetailed recesses of that sort, with no more skill than that of ordinary shipwright work, so as to make them practically water-tight. When such a wooden surface is coated over with another of planking, properly secured with felt or tarred paper between, and also caulked, I can scarcely conceive the possibility, while the hull remains sound, of water finding its way inside. But if the sea water should find its way in, the amount of corrosion that could take place, unless there were a stream of water in and out so as constantly to renew the agents of corrosion, would be next to nothing. I have already shown you that if a piece of iron be put into water already robbed of combined air, or if you exclude the air from it, it will not corrode at all. Therefore, if water should get in and lodge behind any one of these blocks of wood, unless it be perpetually renewed by a stream in and a stream out, the water that has got in there will, after a short time, have next to no power in the way of corrosion. I understand from Mr Grantham that the outer planking will be secured by brass screws.

It appears to me that if these inner blocks were fitted and driven in dry with a reasonable degree of accurate workmanship, they would become water-tight without any caulking whatever. This first coat may be sheeted with brown paper or felt under the planking, and then the planking applied and that caulked. I would then ask, is there any objection to putting on the outer planking with wood trenails in place of with brass screws, as here shown, for in that case there would be absolutely no metallic contact of any sort between the copper or other sheathing and the skin of the ship.

In that case I take it that the copper would produce no effect on the ship. The copper would itself be exposed to the action of the sea, and would be in the condition of the copper of an ordinary wooden ship. Let us now suppose that the ship grounds, or rides over her own anchor, and tears a large piece of the wood coatings off her bottom. It would have to be a very heavy grind, indeed, to strip off the inner blocks, because every block supports every other, and, therefore, you would have to break off many of the rib irons in order to dislodge any of the blocks. But suppose several of them were broken off, and exposure made down to the skin of the ship, I make no doubt but that then the exposed portion of the skin of the ship would corrode much more rapidly than if there were no copper present, because there would then be metallic contact between the copper and the exposed portion of the vessel, made good by the sea water. But then comes the question, *how much greater* that would be. I have mentioned the fact that iron and copper, being in the ratio of 2 to 3, the increased rate of corrosion is in the ratio of 11 to 8. Now, something more than that would be the increased rate at which corrosion would take place in the case supposed. I would merely say this much further, that there would certainly be no such amount of corrosion as to endanger the safety of the ship at sea before she could get home, or into some port where the accident could be repaired. I may mention, in explanation to such chemists as may be present, that in sea water, after exposure for considerable periods of time, the rate of corrosion of iron in presence of copper, or other electro-negative metals, does not follow the law of voltaic equivalents. It may appear strange that copper and iron put together into sea water should corrode in the ratio of 11 to 8, and not in the ratio of the voltaic equivalents. The fact is, however, that the surfaces of both metals when left to themselves in sea water get coated more or less with various insoluble sulphates, and other salts and oxides, derived both from the iron and from the sea water, which alter altogether the rate of corrosion that would otherwise take place were chemical action quite unimpeded. One or two other thoughts of a practical character occur to me. It would appear, with respect to these inner blocks, that there are some woods of which they ought to be, and some of which they ought not. I am quite clear that they ought not to be of pine wood. Pine wood is capable of getting rapidly into a condition of softening and incipient decay on its surface; in that state it rapidly decomposes the sulphates present in sea water, reducing them to sulphurets, which are again decomposed by the iron, and powerfully increase corrosion. Such very soft woods, unless resinous or thoroughly impregnated with creosote, ought not to be adopted. Oak I object to, because, as every one knows, it rapidly acts on iron in contact with it, getting black and hard. It appears to me that a tough timber, elastic, and tolerably hard, would be the right thing. In fact, I doubt if anything better may be found than refuse teak out of the yards, or perhaps Honduras mahogany. For the outside sheathing it does not matter what timber is used, because it only touches the edges of the dove tail ribs. If this sheathing were made of fir these edges might be exposed to a very limited extent to the objectionable action of the incipient decay of pine timber. Therefore, I think it would be found advisable to put a little more iron into this part (pointing to the dovetail heads of the ribs) and so allow for that. Then, the question comes, what effect would be produced upon the inner blocks by the working of the ship? Having given that point some consideration, I doubt that there would be any objectionable effect produced. An iron ship works in more ways than one. At sea every ship vertically works up and down; it also twists. In wooden ships nothing could be more remarkable than the extent of the latter movement. I recollect reading of some old ship of Colliugwood's, the stern of which, when she rolled, tumbled over 8 or 9 inches on each side from the looseness of the framing. That is the sort of motion which would be most likely to dislodge these block—not by any single motion; because, if you suppose the "*Warrior*" twisting even 8 or 9 inches, the effect of any one such movement on any block would be perfectly imperceptible. But if that sort of working were continuous, it would be difficult to say how far it might result in gradually loosening the timber at last. This is a conceivable possibility, but I do not adduce it as a real or a tangible objection. Our ships ought not to work or strain, and my own impression is that not any of these blocks would work loose. I think I have nearly exhausted the observations which it has been desirable to make, unless something should arise in the discussion, when I would ask permission to make further observations. In conclusion, I would say that Mr Grantham's invention seems to me well deserving of a trial upon a large scale and in an effectual manner. Such a trial can, in fact, only be instituted by a Government department—such as the Admiralty.

THE ROYAL AGRICULTURAL SHOW OF IMPLEMENTS, PRODUCTS, AND ANIMALS, IN BATTERSEA PARK, LONDON.

While we write these last pages of our current part, the largest, the most striking, and important agricultural exhibition that the world has ever yet seen, is being rapidly collected and arranged in London, by the Royal Agricultural Society of England. Many past exhibitions of the sort have been held at Provincial counties, or abroad, or at Baker St., at Christmas time, under the familiar name of Cattle Shows, and, so far as belongs to our domain, have been noticed by us. Never before, however, have we had anything to record approaching the magnitude of the present display, nor has probably any collection of this kind previously been shown in a site more appropriate and beautiful.

A space, judging by the eye, which we should suppose not far short of twenty acres, has been temporarily enclosed from the best part of Battersea Park, and here, upon the rich velvety sod, in the purest air at the same level anywhere round London, and surrounded by shrubs and flowers, the multifarious means and appliances, and the marvellous results of our modern farming, the aims, methods, and material ends of England's country life of 1862, are exhibited to the world, now collected in London, by that other greater and more glittering show at Brompton. But though the International Exhibition has a wider scope, a greater extent—embraces the products of all the earth—exteuds itself into the airy regions of poetry through painting and sculpture—while the purely matter-of-fact mind sees nothing in the Battersea Park collection but a cumbrous apparition ending in fat bacon and beef, the more discerning must see in this wonderful exemplificatiou of the amount of mind and science, directed with such signal success, to the culture of the soil—proofs the most hopeful and glorious of the real amelioration of man's estate upon its very widest and most fundamental base, that is silently but steadily and surely being made by our advancing agriculture. The tillage of the land, the earliest occupation of man emerging from the hunter life of the savage, is also necessarily the most widely diffused of all human occupations; whatever, therefore, of inventive skill, mitigates the toil of the peasant, or renders the return of his "sweated brow" more productive, is a gift that in its result is doubly blest—releasing from something of the hardness of his life the actual producer of food in the field, and enriching himself and all the world besides by the increased product of exertion spent. All honour again, then, be to the Royal Agricultural Society of England in having organised this noble exhibition, which cannot fail to mark a very distinct epoch in its useful career, and to cause its influence and power for good to be more palpable and distinctly seen than ever before by our statesmen and social politicians. When our visit was made, on the private view day (21st June), the collection, both dead and alive, was very incomplete, and still chaotic to a great extent; but it was singular to remark how so vast a collection had already been got into order, under sheds of timber and canvas or felt, covering many acres of ground, with so little injury to the beauty and verdure of the sod.

By Monday next, probably the catalogues will be completed, and ready for distribution. The magnitude may be guessed, when we say that there are about six thousand entries of machinery alone. The heavy machinery is about all delivered and in place, and some already at work; but very few of the animals had arrived on Saturday—the owners obviously wishing to let them have the advantage of the repose and accustomed "creature comforts" of their own countries up to the latest moment.

The following is the programme, signed by H. Hall Dare, Esq., secretary of the society, 12 Hanover Square, London, W.

President of the Society—The Right Hon. Lord Portman.

Battersea Park.—Programme.

Governors and members of the society who have paid their subscriptions for *the current year*, will be admitted to the Show-yards, during the time they are open to the public, without payment, by tickets issued by the secretary, which tickets shall not be transferable; and any governor or member who shall be found to transfer or lend his ticket shall be reported to the council, and shall in future forfeit the privileges of membership.

Application for the governors' and members' ticket must be made at 12 Hanover Square, either by post or personally, not later than Saturday, the 21st June, and afterwards at the Secretary's Office, near the entrance to the Show-yard.

Members of the Highland and Agricultural Society of Scotland will be admitted on the same terms as members of this society.

Monday, Tuesday, and Wednesday, June 23, 24, and 25.—The Implement-yard, open from eight o'clock in the morniug till eight in the evening at an admission of 2s 6d for each person.

Wednesday, June 25.—Cattle-yard, open from eight in the morning, at which hour the Judges will commence inspecting the Live Stock, and making their awards.
Admission—Members, free; non-members, One Sovereign.
Persons entering the Cattle-yard from the Implement-yard will be admitted at 17s 6d.
The Show-yards will be closed at eight in the evening.

Thursday, June 26.—The General Show of Cattle, Horses, Sheep, Pigs, and Implements, open to the public from eight o'clock in the morning till eight in the evening; admission, 5s each person.

Friday and Saturday, June 27 and 28.—The General Show of Cattle, Horses, Sheep, Pigs, and Implements, open to the public from eight o'clock in the morning till eight in the evening; admission, 2s 6d each person.

Monday, June 30, and Tuesday, July 1.—The General Show, open to the public from eight o'clock in the morning till eight in the evening; admission, 1s each person.

Wednesday, July 2.—The General Show, open to the public from eight o'clock in the morning till six in the evening, at which hour it will finally close. Admission, 1s each person.

Saturday, July 5.—General Meeting of the members at the "Star and Garter" Hotel, Richmond, Surrey, at twelve o'clock.

Thursday, Friday, and Saturday, June 26, 27, and 28.—Public Exhibition of Steam Cultivators at work, from 11 a.m. to 4 p.m, near Farningham Station in Kent, a distance of 24 miles from the Victoria Terminus of the London, Chatham, and Dover Railway.

There will probably be a large display of foreign stock, although most likely but few foreign implements or machines; indeed, with some few, though important exceptions, foreigners have everything to learn from us, as respects the construction and improvement of agricultural machines, although, perhaps, our breeders may derive not only some novel or useful hints, but obtain some valuable new blood from foreign breeds of cattle, &c.

There is enough, however, of the foreign element to entitle this Show to a coequal designation with its great northern neighbour at Brompton, and to let it take its place as the International Agricultural and Cattle Show; and beyond question, our many Foreign guests now in England will visit it with instruction and pleasure, not unmixed with wonder. It is confidently expected that the Prince of Wales, accompanied by Prince Arthur, will visit the Show on Wednesday next, on which day the judges will award the prizes to the live stock. Invitations have also been issued requesting the honour of the presence of the Duchess of Cambridge, the Grand Duchess of Mecklenburg Strelitz, the Princess Mary, and the Duke of Cambridge, and his Royal Highness the Viceroy of Egypt. Wednesday will possess unusual interest, as it will be the first occasion since the formation of the Society on which the judges will inspect the animals, and award the prizes in the presence of the members of the Society, and such visitors as are willing to pay the extra admission for this privilege. The arrangements for the meeting are progressing most rapidly, and already a large quantity of machinery is deposited in the yard, and a number of foreign stock have arrived in excellent order by the South-Eastern Railway. About 102 head of cattle from France were shipped on board one of the South-Eastern Railway steamers at Boulogne, on Friday morning, landed at Folkestone harbour, and forwarded by special train to the Battersea station, South Coast Railway, arriving there about 5 o'clock p.m., and delivered in the show-yard by 6 o'clock p.m. Although unaided by a catalogue,—we can only venture to say so provisionally, and reserving to ourselves the intention to notice in our next part any speciality that may appear to warrant it,—upon our examination in its present incomplete state, we did not notice any striking novelty, or absolute advance, upon what had appeared at former shows.

About six acres have been enclosed and devoted, at the south side of the whole area, to machinery in motion, and are here drawn up in rank and file like squadrons of steam cavalry—as large and quite as good, if not a better, collection of portable engines as we have yet seen, as well as many traction engines.

Richardson and Darley show a traction engine, carrying its own tank beneath the boiler. Its workmanship did not strike us as particularly good in detail.

Smith Brothers, a traction engine of an extremely compact and adaptable character, and capable of being applied as a portable engine by the aid of a band wheel to any farm work. This engine is an excellent piece of work.

Garrett & Sons, Leiston, Suffolk, exhibit four sizes of portable and traction engines, extremely well finished in more important points than green and vermilion paint. They adopt wood spokes and felloes to their wheels, as do several of the other portable engine builders here exhibiting.

Robey & Co., of Lincoln, show traction engines with suspension wheels of rather peculiar construction. The naves and felloes are of cast iron—the latter cast hollow, and shod externally with wrought iron tynes. The spokes are of wrought iron, and the means of attachment and keeping up at the periphery is concealed in the hollow of the felloes.

Ransome & Sims, however, who show no less than five engines of various sizes, and all admirably turned out of hand, adopt cast iron felloes of a sort of T section, with bosses at the intersection, to which thin wrought iron suspension arms are cast in apparently, outside all is wrought iron shoeing.

Barrett, Exall and Andrews, as usual, come out strongly as portable engine builders. Amongst the innumerable alterations or improvements, real or fancied, in agricultural tools, nothing indeed is so remarkable as the rapid progress towards perfection of these portable agricultural and traction engines. Their spread amongst farmers has been so rapid—

the best proof of their great value, that already their manufacture has become a considerable speciality. Within ten years more agricultural engine building will have, as such, taken rank with locomotive land and marine engine construction. Great separate establishments for breeding this steam stock will have been formed, and a little later future, will undoubtedly see the introduction of steam traction to a vast extent upon common roads, and a corresponding diminution of animals of draught. In the country, the first great advantage of this will be the reduction of the number of draught horses, and the economization of the food they consume. The immediate consequences of this upon the farmer's polity, will be a corresponding increase in the number of his cattle, sheep, and hogs—more stuff to go to market; and, as a next result, a better supply of manure for his land, and from that—better production still—thus it is that nature's bounties are given back with interest a thousand fold, when sought aright. That is to say, as God designed, not by labour, brute toil, but by knowledge and labour together. Thus it is that every improvement is but the finger post to a further one—*vires acquirit eundo.*

But it is in cities, and amidst the toil and traffic of docks and wharves and crowded roads and hard paved streets, where in literal truth—"the whole (horse) creation groaneth and travaileth together," that the not very remote future of steam traction presents itself in the brightest colours to every man that desires the relief of animal suffering. We must not here pursue the theme—brilliant, but not Utopian—and full of future hope and joy; it is one large and important enough to be treated, and, as we hope, at a future time, in a systematic manner.

Another most suggestive thing that strikes one here—is the immense and rapid spread of field thrashing machines, preparing the grain for market on the spot. A legion of these is driven by the steam cavalry we have spoken of; and the next stage beyond those machines has now appeared—semi-portable and portable mills for grinding corn and preparing it into flour and bran—begin to show themselves very prominently. How vast and how valuable is the future prospect to the farmer to which this leads. Time was in England (and not so remote too in our own county of Devon) when to the one little mill in the whole parish, which only ground for hire, every farmer had to send his grain in small parcels to be made into flour for the food of his family and his farm servants; and he not only paid for its grinding a fixed rate, but the miller by custom took a heavy toll in kind from the flour he produced. Then came—nay even now it is the rule—the establishment of *great* corn mills—the Albion Mills, ever connected with the names of Watt & Rennie, being one of the first. The improvement was a ready and certain market for his grain to the farmer, but attended with this evil—that, as in all approaches to a power of monopoly, the farmer is sometimes obliged to accept worse terms from the milling capitalist for his grain than he is entitled to. The way to his relief is now prepared.

He has the means for grinding his grain himself; and if the miller will not give him fair terms, he can compete with him on his own ground, and sell his produce as flour. In any case, the large farmer, in bread eating countries, will save the miller's profit upon the flour consumed by his own farm servants and domestics.

Marshall & Sons, of Gainsborough—besides some extremely well made agricultural engines, the wheels of which they make mainly of timber—show some capital cast-iron circular saw benches, with well made guide frames, specially designed for cutting feather-edged and other forms of boards useful about the farm. Rushton & Proctor also have some excellent tools of this description, though, perhaps, a little complex in the guide frames. One of the very best and most ingenious machines exhibited is that of Mr Henry Wright, of Boston (No. 333), for mechanically hoisting up trusses of hay or straw to either loft or barn. It cannot fail to answer, we should think, nor be likely to get deranged in any way by work. There are in the second great enclosure—devoted to all the other implements not in motion, and of which there are whole streets, with swarded ways between—some very nice self-acting mechanical styles or stop-gaps shown by Annies & Barford, Patentees.

Clayton comes out in great power with further improvements on his already excellent brick-making machinery; and there are several other exhibitors in that department. We, however, must reserve further notices for the present.—Ed.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ANNUAL LIST OF PRIZE SUBJECTS—SESSION 1862-63.

The Royal Scottish Society of Arts proposes to award Prizes of different values, of thirty sovereigns and under, in gold or silver medals, silver plate, or money, for approved communications *primarily* submitted to the Society, relative to inventions, discoveries, and improvements in the *mechanical* and *chemical* arts in general, and in their relation to the fine arts, and also to means by which the *natural productions* of the country may be made more available. The Society suggests the following as a few of the many subjects that may be attended to, viz:—

I.—Inventions, Discoveries, or Improvements in the Useful Arts.

1. *Mechanical Arts.*

Inventions or Improvements in applying the motive power of men and animals,—in wind and water prime movers,—in steam and other heat-engines,—in pumping, blowing, rolling, sawing, agricultural, and other engines and machines,—in cotton and other textile manufacturing mills,—in ship-building, wood, iron, and steel,—in lighthouses,—in marine propellers,—in railways, plant, and signals,—in electro-magnetic motive power,—in electric and other telegraphic apparatus, sub-marine and aërial,—in photographic apparatus,—in fire-proof buildings,—in water supply,—in paving,—sewerage,—in economical appliances for increasing the sanitary condition of towns,—in smoke consumption and extinguishing fires,—in gas works,—in canals and inland navigation,—in tools, implements, and apparatus for the various trades,—in bricks, encaustic tiles, cements and mortars,—in printing machines, cases, and rollers,—in stereotyping,—in cranes,—in the machinery for collieries,—in preserving timber and metals in marine works,—in optical apparatus for astronomy, surveying, and levelling,—in manufacture of paper,—experiments on the effect of low temperatures on metals.

2. *Chemical Arts.*

Inventions or Improvements in new and useful applications of gutta percha and vulcanized india rubber, or similar gums,—in the economical extraction of chemical principles or useful substances, as paraffin, &c., from coal,—porcelain clay from granite or felspar,—and metals generally from their ores and oxides,—in dyes,—in paints,—in paper,—in glass, especially for lenses,—in methods of rendering the electric light available in practice.

3. *Relative to the Fine Arts.*

Inventions or Improvements in photographic processes, in "carbon" printing, and in methods of printing photographs from their impressions on steel or copper plates, or lithographic stones,—in electrotype processes,—in die-sinking,—in methods of illustrating books, to be printed with the letterpress,—in paper-hangings,—in articles of porcelain, common clay, or metal,—in glass staining,—in engraving on stone,—in chromo-lithography,—in "nature" printing.

4. *Natural Productions.*

Discovery of plumbago mines,—whetstones,—of woods suitable for engraving.

II.—Experiments applicable to the Useful Arts.

III.—Communications of processes in the Useful Arts, practised in this or other Countries, but not generally known.

IV.—Practical Details of Public or other Undertakings of National importance, already executed, but not previously published;—or valuable suggestions for originating such undertakings.

The Keith Prize, value Thirty Sovereigns.

For some important "Invention, Improvement, or Discovery, in the useful arts, which shall be primarily submitted to the Society" during the session.

The Hepburn Biennial Prize, value about £12.

"For such Inventions or Communications submitted to the Society as shall be approved of by the Society, or by their Prize Committee."

The Makdougall Brisbane Biennial Prize, value £10.

"To the authors or inventors of Communications of Merit, which shall be approved of by the Society, or its Committee, and judged by them deserving of such distinction."

The Reid and Auld Prizes.

For the first, second, and third best Models of "anything new in the art of Clock or Watch making,—by journeymen or master watch and clock makers;"—if these should be considered worthy of prizes, the year's interest of the Reid and Auld Bequest, being about Seven Guineas, divided among them in such proportions as the Prize Committee shall fix, according to merit. To such as deserve it, the Society may add to the amount of the Prize out of its general funds.

The directions for preparing and lodging Communications, may be had on application to Mr John B. Bell, Secretary to the Society, Edinburgh.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the last ordinary Monthly Meeting of the Executive Committee of this Association, Mr L. E. Fletcher, chief engineer, presented his Monthly Report, of which the following is an abstract:—

"During the last month there have been examined 316 engines, and 464 boilers. Of the latter, 9 have been examined specially, 10 internally, 74 thoroughly, and 371 externally; in which the following defects have been found:—Fracture, 6 (3 dangerous); corrosion, 50 (7 dangerous); safety-valves out of order, 6; water gauges ditto, 15; pressure gauges ditto, 5; feed apparatus, 1 (dangerous); blow-off cocks ditto, 34 (2 dangerous); fusible plugs ditto, 6; furnaces out of shape, 6; Total, 129 (13 dangerous).

Boilers without glass water gauges, 29; without pressure gauges, 10; without blow-off cocks, 34; without back pressure valves, 33.

"Explosions continue to occur to every description of boiler. One has happened during the last month to a locomotive in the vicinity of London, and another to a stationary boiler on the Clyde. Both of these were, as it is hardly necessary to state, beyond the sphere of the operations of this Association. Each of these explosions was attended with fatal consequences, but I am not at present in possession of the engineering facts.

"The recent very frequent occurrence of explosions has monopolised, by the bare recital of their details, the entire space of the late Reports, and left no room for considerations resulting from them, to which I think it is important attention should be drawn, and which, therefore, I now purpose to do.

"It will be remembered that one of the late explosions arose from the failure of an angle iron, on which alone—as on a single thread—a large crown plate depended for its support. Several other explosions occurred to externally-fired boilers, through failure of the plates just at the seams of rivets exposed to the flame. In some of such cases the plate is found to crack at the rivet holes; in others leakage occurs, from which corrosive action sets in, and steadily continues until the plates become so thinned that rupture and explosion ensue. Some explosions have occurred from corrosion consequent upon external damp; others, from acidity of the water; while others again, of somewhat earlier date, have been occasioned by the collapse of the furnace tubes, consequent upon weakness of construction, which would have been remedied by the adoption either of flanged seams, T or angle iron hoops, or other similar means.

"Thus it will be seen that all the above explosions occurred from the most simple causes, and that no mystery whatever need be attached to any one of them; while by suitable construction of the boilers in the first place, and due attention to their state of repair in the second, these explosions would in every case have been prevented.

"I am extremely desirous to keep this practical view of steam boiler explosions constantly in sight, since I am persuaded no head will be made against them generally, as long as their causes are considered to be matters of mystery, and their occurrence one of chance.

"Very few of the explosions that come under my notice occur from shortness of water, and I believe that to be a much abused idea, and the number of explosions resulting from it to be much exaggerated. It appears to be an almost stereotyped verdict at inquests, and the boiler attendant being frequently killed, there is seldom any witness to the contrary.

"I find that by far the most frequent cause of explosion is the insufficiency of the boiler for its working pressure, either on account of its original construction, or state of repair consequent upon use; while those explosions resulting either from deficiency of water, or from extraordinary or reckless pressure, are comparatively rare. In other words, to prevent misapprehension, I find that explosion is more frequently due to weakness of the boiler than to excessive pressure of the steam.

"I know no means of ascertaining the sufficiency of the original construction of a boiler, or of detecting the weakening effect produced upon it by wear and tear—in short, of testing either new or old boilers—equal to the use of hydraulic pressure, and think all steam users would do well to make systematic use of this test once a year. In France, I believe, this plan is rendered compulsory by the Government, and it would be well were it generally adopted in this country voluntarily. Weak places in the plates may pass undetected, even on careful examination, while some parts may be inaccessible and concealed from view, but the hydraulic test is sure to detect and expose them all. Its timely application would have saved that most disastrous explosion which occurred some time since here in Manchester, at a locomotive establishment second to none in the kingdom for its high reputation; and since a defect passed unnoticed at such an establishment, where the construction of boilers, as well as the quality and strength of plates, may well be supposed to have been thoroughly understood, it surely argues the necessity of the hydraulic test being generally applied.

"Mr Muntz, a steam user in Birmingham, states, in a letter published on the Millfield boiler explosion, that he has for years adopted, with advantage, the plan of an annual hydraulic boiler test, and considers it a duty he owes to his workmen in consideration of their safety.

"The application of the hydraulic test is so simple, and the pump required so small, that each steam user could provide himself with one at very little expense; or some parties might find it worth their while to take up the proving of boilers by water pressure, as an itinerant speciality of engineering practice. This Association would be glad to assist in the general application of the hydraulic test, by inspecting the boilers when under pressure; and I feel convinced that, were the practice of this annual test generally adopted, which I trust it soon will be, explosions would become nearly, if not entirely extinct."

GEOLOGICAL SOCIETY OF DUBLIN.

Anniversary, 14th Feb., 1862.

PRESIDENT'S ADDRESS—(*Continued from page* 80.)

With respect to the igneous or aqueous origin of granite, geologists in recent times have almost unanimously advocated the igneous theory, and chemists the aqueous theory.

The evidence of the geologists has been collected in the field, and though it is wanting in the scientific precision which the chemists have called to their aid, yet it possesses a force which all the arguments on the other side have, as yet, failed to oppose. The evidence in favour of the igneous origin of granite is essentially physical, and founded on the observation, in the field, of the manner in which granite is found to penetrate, in minute veins, every rock older than itself with which it comes in contact. It appears to me that no pasty condition of granite, such as that imagined by our distinguished honorary member Delesse, and that no aqueous solution of granite, can account for the remarkable group of physical facts which geologists have collected on this subject since the days of Hutton; and that we must admit that when granite penetrated the schists and limestones beside it, in small veins, it must have had liquidity greater, perhaps, than that of any lava with which we are acquainted, except, probably, the siliceous lava of the Sandwich Islands. On the other hand, the arguments derived from chemistry appear to me equally unanswerable, in showing that water was present in abundance during the formation of granite, and that in some cases it is even to be regarded almost in the light of a chemical precipitate, from an aqueous solution.

Before attempting to reconcile these opposite views, let us consider for a moment the arguments of the chemists. They are as follow:—

I. The specific gravity of the quartz that occurs in granite is known to be 2·6, which Count Schaffgotsch has proved to be the specific gravity of silica formed by aqueous solution; while the specific gravity of silica which has undergone igneous fusion is only 2·2.

II. Fuchs has shown that in granite we have several minerals—quartz, felspar, mica—whose points of fusion are very different; and yet they have not crystallized in the order of their infusibility, but in the inverse order, viz., of their fusibility; the most infusible of them all, quartz, having crystallized last, and acted the part of a mother-liquor to the others.

III. Professor Heinrich Rose observes that the presence of such minerals in granite as Oligoclase, the Micas, Hornblende, etc., in presence of free silica, is inconsistent with the hypothesis of igneous fusion; as such fusion would convert these minerals into more highly silicated forms.

IV. Lastly, the actual presence of large quantities of water (4 per cent.) in margarodite mica, which forms an important constituent of the granites of Leinster and Donegal; and the occurrence of such minerals as Allanite, Gadolinite, etc., in the Norway granites, minerals which intumesce and change their properties on ignition; the presence of such minerals as these in granite appears to many chemists inconsistent with the theory of igneous fusion.

Of these arguments, I confess that the first and fourth alone appear to me to be conclusive; and that the force of the second and third may be evaded by an appeal to our ignorance of the manner in which "liquation" may operate in determining the order and manner of crystallization of minerals forming on the cooling of a mixed magna, after igneous fusion. Indeed, with respect to the second argument, which requires quartz to crystallize first in granite, I am only acquainted with two rocks in which this condition has been fulfilled, by the separation of the quartz in the form of double hexagonal pyramids. These two rocks are—the felspar porphyry of Forkhill, in the county of Armagh, and the granite of Slieve Corragh, in the county of Down. The porphyry of Forkhill would be pronounced by any geologist to be a metamorphic slate, and not a fused rock, and yet it fulfils Fuchs' condition of igneous fusion, by the apparent order of crystallization of its constituent minerals.

The following analysis shows the composition of the Forkhill porphyry:—

Forkhill Porphyry.

	Percentage.
Silica, ...	76·00
Alumina, ...	8·72
Iron (peroxide), ...	5·33
Lime, ...	0·79
Magnesia, ...	0·11
Soda, ...	0·88
Potash, ...	7·82
Iron (protoxide), ...	0·15
Manganese (protoxide), ...	0·20
Water, ...	0·40
	100·40

Physical Description of Forkhill Porphyry.

A felspathic quartziferous porphyry. Sp. gr. =

Paste, greyish, honey yellow, of felstone texture, dull lustre.

Quartz crystals very perfect ($\frac{1}{8}$ in.), studded abundantly through the paste in six-sided pyramids and prisms.

Rare black specks, like hornblende, sometimes segregating themselves into lenticular masses.

The argument against the igneous origin of granite derived from the specific gravity of its quartz, appears to deserve much attention, from the fact, that the difference of density observable in bodies crystallizing from aqueous and igneous fusion (the former exceeding the latter) appears to be universal, and attributable to the retention of latent heat by the substance exposed to igneous fusion.

Thus sulphur, as is well known, crystallized from its solution in chloride of sulphur or bisulphuret of carbon, has a specific gravity of 2·05; while the crystals formed from melted sulphur have only a specific gravity of 1·93; and the third variety of sulphur, known as ductile sulphur, formed at a still higher temperature, has a still less specific gravity, being only 1·957.

But we need not have recourse to the analogies of chemistry to show the diminution in specific gravity which granite or quartz would undergo if fused.

M. Delesse has published experiments on the specific gravity of various

rocks in their natural and artificial fused or vitreous condition, from which I have calculated the following table:—

Table of Specific Gravities of natural and artificially fused Rocks.

Name of Rock.	Specific Gravity of Natural Rock.	Specific Gravity of the Glass.	Number of Specimens	Difference.
Granite, quartz-porphyry,	2·6626	2·3913	3	0·2713
Syenitic granite,	2·6677	2·4500	3	0·2177
Granite porphyry,	2·6510	2·4250	1	0 2260
Porphyry,	2·6872	2·4400	5	0·2472
Diorite,	2·8593	2·6570	3	0·2023
Melaphyre,	2·7750	2·6040	1	0·1710
Trachyte,	2·7270	2·6170	1	0·1100
Basalts,	2·8524	2·7700	5	0·0824
Modern lava,	2·5233	2·4919	8	0·0314

It appears to me that the column of differences in the preceding table greatly strengthens the argument of those chemists and geologists who believe that water played a much more important part in the formation of granites and traps than it has done in the production of trachytes, basalts, and lavas, and that they owe their relatively high specific gravity to its agency.

The only manner in which it seems possible to reconcile the opposite theories of the origin of granite, derived from physical and chemical arguments, is to admit for granite what may be called a hydrometamorphic origin, which is the converse of what is commonly called metamorphic action, but which might more properly be designated as pyrometamorphic action. The metamorphism of rocks might thus be assumed to be two-fold: hydrometamorphism, by which rocks, originally fused, and when in liquid fusion, poured into veins and dykes in pre-existing rocks, are subsequently altered in specific gravity and arrangement of minerals, by the action of water acting at temperatures which, though still high, would be quite inadequate to fuse the rock; and pyrometamorphism, by which rocks originally stratified by mechanical deposition from water come to be subsequently acted on by heat, and so transformed into what are commonly called the metamorphic rocks.

Granite, it appears to me, although generally a hydrometamorphic rock, may occasionally be the result of pyrometamorphic action; and such appears to have been its origin in Donegal, in Norway, and, perhaps, in the chain of the Swiss Alps.

MONTHLY NOTES.

MARINE MEMORANDA.

The Shannon.—This screw frigate, Capt. Wainwright, recently resumed her experimental trials at Portsmouth, steaming out of harbour at noon for the trial ground in Stokes Bay. The screw tested on this occasion was the double-bladed "Mangin." It was cast in the new foundry of Portsmouth dockyard, but copied from the screw now in use in the French Imperial navy, into which it was introduced by M. Mangin, the inventor, some few years since. This screw was fitted to the *Austerlitz*, and other French ships of war, at the time the Anglo-French fleets proceeded to the Baltic on the outbreak of hostilities with Russia; but it never obtained a reputation superior, if equal, to that of our common Admiralty pattern screw. It required a less aperture, however, in ships' sterns when necessarily lifted. Other advantages were also claimed for it by its advocates. The weather was in the highest degree favourable for developing the power of any propeller, the wind being light and the water perfectly smooth. The draught of water by the ship was within one inch of the previous day aft, and the same forward, being 20 feet 2 in. aft, and 21 feet 9 in. forward. On clearing the harbour channel the ship at once proceeded to the trial ground, and six runs were made at the measured mile. The time and speed were respectively—in the 1st, 5 min. 9 sec., 11·650 knots; in the 2d, 5 min. 36 sec., 10·714 knots; in the 3d, 4 min. 55 sec., 12·203 knots; in the 4th, 6 min. 2 sec., 9·944 knots; in the 5th, 4 min. 36 sec., 13·043 knots; and in the 6th, 6 min. 9 sec., 9·756 knots. In the fifth and sixth runs the number of revolutions was 53½, in the others 53. Mean speed of the whole, 11·331 knots. At the conclusion of the runs at the measured mile, the ship was taken off to a fitting position, and her time ascertained in making a complete circle, with the helm to port and also to starboard, the time being taken from the moment of giving the order. The same number of men (five)—in fact the same men—were at the wheel as were there on the previous day. The helm was first put hard aport, and the rudder was hove over to an angle of 13¾ degs. in 28 seconds. The circle was completed in 7 minutes and 14 seconds. The helm being next put to starboard, the rudder was hove over to an angle of 15⅛ degrees in 30 seconds, and the circle completed in 7 minutes and 1 second. The engines during the time of making both circles averaged 52 revolutions. It will be seen, therefore, by comparison with the trial of the Admiralty pattern, or common screw, that the Mangin screw obtained a slight advantage, but very slight, certainly, in point of speed, and that the ship also came round in less time than she did on the preceding trial. Both these apparently slight advantages were fully accounted for by the peculiarly favourable conditions of wind and weather under which the Mangin screw was tried. On the other hand, the Mangin communicated to the ship a far greater vibratory motion than did the common screw, had an unusually violent "beat" in its revolutions through the water, and raised a column of water beyond what is usual in the screw well.

The monster smooth-bore gun, weighing 22 tons, at Portsmouth, known as the "Horsfall" gun, is ordered to be delivered up to the Mersey Steel and Iron Works Company for removal to Liverpool, where it will undergo some alteration in the breech plug to remove the small flaw or defect existing in the chamber of the piece.

MISCELLANEOUS.

Paraffin.—Messrs J. C. & J. Field, of the Paraffin Candle Works, Lambeth Marsh, London, have lately issued a little pamphlet for distribution, containing an account of the origin, manufacture, and application of paraffin, together with a brief sketch of the various materials employed for the purposes of illumination. We are here told that the German chemist Reichenbach was the discoverer of paraffin, in the course of his elaborate researches upon the products derived from the distillation of tar and bituminous matters. He considered it, however, as nothing more than an interesting chemical product; and it was not until Mr James Young, of Glasgow, discovered a method of extracting it from coal, that its application to the purposes of illumination came to be made. It is always found, says the pamphlet, among the products of distillation, dissolved in various oils of different specific gravities, from which, upon depressing the temperature, the solid paraffin crystallizes out in scaly masses, and may be partially purified by simple pressure. The importance of attending to the amount of heat applied to the material from which it is proposed to extract the paraffin, cannot be too emphatically insisted upon. Tars, when formed at a moderate temperature, lower than that usually employed for the manufacture of gas, contain naphtha, a certain amount of benzole, paraffin, and naphthaline: and where a cherry-red heat has been applied, the tars are free from paraffin, the white crystaline compound sometimes mistaken for that body being naphthaline. Hence the temperature must be *above* that point at which naphtha or benzole is produced,—it must be *below* that at which naphthaline is formed: within this range paraffin is produced, and the desirable temperature therefore is between the formation of the naphtha on the one hand, and the abundant formation of naphthaline on the other.

As the production of gas begins where that of paraffin and its congeners ends, the importance of regulating the heat can be easily understood, and, as a consequent, the two processes cannot be carried out simultaneously. Paraffin, the desired solid portable gas of Liebig, becomes ordinary gas at higher temperatures. Hence, in gas works, which have for their object, as their name implies, the production of invisible air, destined to pass through interminable miles of pipes, ultimately to be consumed in our streets and dwellings, little or none of the solidified gas, "white, portable, and inodorous," is yielded. This is formed at a far lower stage of decomposition. The oil obtained by distillation is placed in a vat; the temperature is depressed, and the solid portions crystallize out after some weeks in large scales, and by an ingenious contrivance, in which the centrifugal force is called into play, the solid and liquid portions are separated. The paraffin is then melted and run into squares, and submitted while cold to the hydraulic press, under a pressure of about 300,000 lbs. It is re-melted, and treated with about half its weight of strong sulphuric acid, at a temperature of about 356° F. At the end of two hours the paraffin separates from the acid, and is washed with water; it is then run into cakes, and pressed, while hot, in the hydraulic press; again melted, mixed with caustic potash, which precipitates all impurities, leaving the paraffin as limpid as water. The use of spirit for the purpose of dissolving the pitchy and tarry matters, is resorted to by many manufacturers.

As regards the illuminating power of Messrs Fields' paraffin candles, compared with that of wax, spermaceti, stearic, and the best composite candles, each being allowed to burn at its own rate, Dr Letheby has tabulated the following results:—

CANDLES (Six to the Pound.)	Average Rate of Combustion per Hour.	Illuminating Power (Standard Sperm being = 100.)	Illuminating Power, Each Candle burning at standard Rate of 120 grains per Hour.	Consumption per Hour, to give Standard Light of a Sperm Candle.
	(Grains.)			(Grains.)
Composite	144	93	78	155
Stearic	140	97	83	144
Wax	168	122	87	138
Spermaceti	132	110	100	120
Paraffin	122	125	123	98

These results prove that, weight for weight, the illuminating power of paraffin is rather more than 22 per cent. greater than that of spermaceti, about 40 per cent. greater than wax, 46 per cent. greater than stearic, and 58 per cent. greater than composite; or, to estimate it in another way, the light produced by 98 lbs. of paraffin candles is equal to that of 120 lbs. of spermaceti, or 138 lbs of wax, or 144 lbs. of stearic, or 155 lbs. of the best composite candles. This high illuminating power of paraffin is due to the circumstance that it contains a large proportion of carbon: it is, indeed, among the richest of the hydrocarbons, and therefore it burns with a very intense light, and requires an unusually small wick. The products of its combustion are the same as those of wax and spermaceti, and are free from sulphur compounds.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING JUNE 29, 1862

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	D	£	s	n	£	s.	D.	£	s.	D.
Bars, &c., British, per ton,	5	15	0	5	15	0	5	15	0	5	15	0
Nail Rods,	7	5	0	7	10	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	15	0
Sheets,	8	10	0	8	10	0	9	0	0	9	5	0
Pig, No 1, Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	0	0	7	0	0	7	0	0
Rails,	5	7	6	5	10	0	5	10	0	5	10	0
Pig, No. 1, Clyde,	2	11	9	2	12	0	2	11	0	2	12	0
Swedish in bond,	11	5	0	11	15	0	11	15	0	11	15	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	0	0
In faggots,	17	0	0	17	0	0	17	0	0	16	10	0
SPELTER, ingot,	17	10	0	17	15	0	17	10	0	17	10	0
ZINC, sheet,	23	10	0	23	15	0	24	0	0	24	0	0
COPPER.												
Sheathing bolts, pr lb.,	0	0	11	0	0	10¾	0	0	10¾	0	0	10½
Bottoms,	0	0	11	0	0	11	0	1	0	0	0	11
Old,	0	0	9¼	0	0	9	0	0	9	0	0	9
Tough Cake, per ton,	93	0	0	93	0	0	93	0	0	92	0	0
Tile,	93	10	0	93	0	0	94	0	0	94	0	0
TIN.												
English blocks, per ton, duty free,	116	0	0	116	0	0	114	0	0	114	0	0
Bars in barrels,	119	0	0	119	0	0	115	0	0	115	0	0
Refined,	119	0	0	119	0	0	119	0	0	119	0	0
Banca, in bond,	121	0	0	121	0	0	121	0	0	121	0	0
Straits, ditto,	114	0	0	114	0	0	114	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	2	6	1	2	6	1	2	6
LEAD.												
English pig,	20	0	0	21	0	0	21	5	0	21	5	0
Sheet,	21	0	0	21	10	0	20	10	0	21	10	0
Spanish pig, in bond,	19	10	0	19	15	0	20	0	0	20	0	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	3	15	0	3	10	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	15	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	10	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	10	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	42	0	0	42	0	0	42	0	0	42	0	0
" yellow,	34	0	0	35	0	0	37	0	0	37	0	0
Sperm,	90	0	0	90	0	0	92	10	0	92	0	0
Cod,	39	10	0	40	0	0	40	0	0	40	0	0
South Sea,	36	0	0	37	0	0	37	0	0	37	0	0
Olive, Gallipoli, per tun,	56	10	0	57	0	0	57	0	0	57	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	49	10	0	50	10	0	50	0	0	50	0	0
Rape pale foreign,	52	0	0	52	0	0	52	0	0	53	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	34	10	0	34	0	0	34	0	0
Jute,	14	0	0	13	10	0	14	10	0	14	10	0
Hemp Rope,	24	10	0	24	0	0	24	0	0	24	5	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

21st April, 1862

1154. John Pickard and Thomas Morris, Preston—Furnaces.
1155. S. P. Matthews, Wolverhampton—Vices.
1156. S. F. Griffin, New Adelphi Chambers—Vessels of war.
1157. Abraham Marks, Cannon Street Road—Artificial feathers.
1158. E. F. Clarke, Waterloo, near Liverpool—Propellers.
1159. R. A. Brooman, Fleet Street—Protectors for covering metal.—A com.
1160. Frederick Tolhausen, Paris—Horse-shoes.—A com.
1161. Thomas Attwood, Lewes, Sussex—Kitcheners.
1162. Charles Callebaut, Paris—Sewing machines.
1163. Adam Dixon, Birmingham—Knife and fork cleaning machines.
1164. J. C. Amos, Southwark—Supplying surface condensers with water.
1165. C. C. Creeke, Bournemouth—Drain pipes.

22d April, 1862.

1166. Thomas Lea and Samuel Smith, Smethwick—Burglary alarms.
1167. E. H. C. Monckton, Thurloe Place—Umbrellas, &c.
1168. S. S. Putnam, Dorchester, U.S.—Forging nails.
1169. C. E. Elliott, Aldermanbury Postern—Dried yeast.—A com.
1170. Charles Webster, Park Steps, Radford—Self-acting fountains.
1171. Arthur Warner, Threadneedle Street—Vessels of war.
1172. J. H. Johnson, Middlesex and Glasgow—Propelling ships.—A com.
1173. George Scoville, Furnivals Inn—Pistons.—A com.
1174. Robert Boby, Bury St. Edmunds—Rolling land.

23d April, 1862.

1175. Richard Jinks, Upper King Street—Venetian blinds.
1170. Luke Holden, Burnley—Harness.
1177. William Moir, Manchester—Specific gravity of liquids.
1178. G. N. Bates, New Basford, Nottingham—Dressing lace.
1179. G. H. Birkbeck, Chancery Lane—Lubricating.—A com.
1180. William Carpenter, Greenwich—Printing in colours.
1181. James Price, Dundalk, Ireland—Spikes for railways.
1182. A. Robertson, Dublin, and Richard Barter, Blarney—Projecting fluids.
1183. William Fear, Bristol—Saw plates.
1184. Alfred Hodgkinson, Belfast—Bleaching.
1185. J. H. Johnson, Middlesex and Glasgow—Deep sea soundings, and recording the speed of ships.—A com.
1186. G. T. Bousfield, Brixton—Elliptic springs.—A com.
1187. A. V. Newton, Chancery Lane—Looms.—A com.
1188. W. E. Newton, Chancery Lane—Fertilizing composition.—A com.
1189. W. E. Newton, Chancery Lane—Imitation lace.—A com.
1190. C. E. Heinke, Great Portland Street—Diving helmets.

24th April, 1862.

1191. John Endean, Walworth—Cocks, taps, and valves.
1192. William Haggett, Sherborne, Dorsetshire—Engines and carriages.
1193. Henry Whcatley, Mirfield, Yorkshire—Steam for drying purposes.
1194. John Bond, Burnley—Projectiles.
1195. W. D. Ruck, Duke Street—Grease from coal tar.
1196. John Winsborrow, Marlborough Road—Wet gas meters.
1197. George Davies, Seven Sisters' Road—Matting.
1198. J. A. Traverseir, France—Ladies' bonnets.
1199. J. F. Allen, New York, U.S.—Slide valves.
1200. G. W. Belding, King Street—Harrows or cultivators.—A com.
1201. Frederick Dangerfield, Bedford Street—Lithographic presses.
1202. Robert Mushet, Coleford—Puddling furnaces.
1203. Joseph Offord, Wells Street—Carriages.
1204. Rudolf Zimara, St. Petersburg, Russia—Stoves.
1205. T. W. Ashby, Stamford—Motive power.—A com.

25th April, 1862.

1206. S. C. Salisbury, Coventry—Sewing machines.
1207. Frederic Barnett, Paris—Signals.
1208. George Richards, Caroline Street—Ordnance and projectiles.
1209. J. F. Brunet, King William Street—Fringes.—A com.
1210. R. C. Mansell, Ashford—Wheels.
1211. P. R. Drummond, Perth—A revolving rake.
1212. J. T. Davies, Liverpool—Circuit horse powers.—A com.
1213. R. P. Roberts, Exeter Villas—Paper and copying ink.
1214. John Elder, Glasgow—Engines and boilers.
1215. John Shaw, Liverpool—Engines and indicators.—A com.
1216. James Aspinall, Middlesborough-on-Tees—Apparatus for conveying to land ships' papers, &c., when casualties occur at sea.
1217. Charles Reed, Kintbury—Treating sorghum saccharatum.
1218. A. C. Kirk, Batbgate—Refrigerating apparatus.
1219. Augustus Applegarth, Dartford—Printing in colours.
1220. William Hale, John Street—Rockets.
1221. William Fisken, Stamfordham—Cultivating land.
1222. Lachlan M'Lachlan, Manchester—Regulating light.
1223. E. A. L. Negretti and J. W. Zambra, Hatton Garden—Thermometers.
1224. W. E. Newton, Chancery Lane—Chimneys for lamps.—A com.

26th April, 1862.

1225. D. C. Le Souef, Twickenham—Nails, bolts, &c.—A com.
1226. T. U. Brocklehurst, Macclesfield—Reeling singles and sewing silks.
1227. G. H. Law, Rochester Road—Draining flower plots.
1228. J. G. N. Alleyne, Alfreton—Iron and steel.
1229. Emile Alcan, Coleman Street—Carding engines.—A com.
1230. William Clark, Chancery Lane—Collars.—A com.
1231. S. and G. Cheavin, Boston—Purifying water.
1232. F. G. Spilsbury and F. W. Emerson, Stratford—Fusee oil.
1233. Arthur Boyle and Thomas Warwick, Birmingham—Hair pins.
1234. H. W. Hart, Manchester—Reflectors and shades.
1235. Gustav Bischof, Swansea—Copper and silver.
1236. G. H. Smith, North Perrott—Crinolines.
1237. Aaron Lester, Coventry—Berlin needlework.
1238. A. V. Newton, Chancery Lane—Hollow glass ware.—A com.

1239. A. V. Newton, Chancery Lane—Lamps.—A com.

28*th April*, 1862.

1240. G. B. Goodman, Baker Street—Accidents in mines.
1241. John Burnie, Castle-Douglas—Tobacco pipes.
1242. John Fletcher, Farnham Place—Saccharine liquids.
1243. Robert Vaile, Auckland, New Zealand—Propellers.

29*th April*, 1862.

1244. W. T. Glidden, Massachusetts, U.S.—Guano.—A com.
1245. G. R. Samson, Old Chapel Row—Musical instruments.
1246. H. F. Wells, Woolwich—Cramps for joiners' work.
1247. J. W. Caley and F. G. Caley, New Windsor—Textile fabric.
1248. J. E. A. Gwynne, Strand—Lifting, forcing, and exhausting.
1249. R. E. Dixon, New York, U.S.—Pipe and tobacco pouch.
1250. S. W. Newington, Gondhurst, Kent—Flow of liquids.
1251. Edwin Clark, Great George Street—Arches.—A com.
1252. William Clark, Chancery Lane—Preserving animal substances.—A com.
1253. John Ross, Chancery Lane—Grinding stones.—A com.
1254. Richard Bright, Bruton Street—Lamps.
1255. John Cliff, Lambeth—Insulators.
1256. W. L. Tizard, Mark Lane—Heating and condensing apparatuses.
1257. D. M. Childs, New Oxford Street—Steam engines.—A com.
1258. D. M. Childs, New Oxford Street—Reaping machines.—A com.
1259. D. M. Childs, New Oxford Street—Movement of machinery.—A com.
1260. E. B. Wilson, Parliament Street—Iron and steel.
1261. W. E. Newton, Chancery Lane—Cleaning wool.—A com.
1262. W. E. Newton, Chancery Lane—Mowing machines.—A com.
1263. Michael Henry Fleet Street—Aerating liquids.—A com.

30*th April*, 1862.

1264. Edward Moore, Tewkesbury—Dress shirts.
1265. Alfred Travis and Benjamin Travis, Dukinfield—Carding engines.
1266. A. I. Mahon, Dublin—Projectiles.
1267. John Harrington and Thomas Perkins, Birmingham—Mounting photographs.
1268. George Davies, Serle Street—Electric apparatus.—A com.
1269. George Davies, Serle Street—Nails and screws.—A com.
1270. A. T. Mercier, France—Looms.
1271. James Maiden, Waterloo, Lancashire—Safety lamps.
1272. Evan Leigh, Manchester—Ships and floating batteries.
1273. Thomas Piatti, Paris—Propulsion of vessels.
1274. Henry Hickman, Park Road—Fastening crinoline skirts.
1275. James Oxley, Sheffield—Cutting bread.
1276. G. H. Birkbeck, Southampton Buildings—Couches or settees.—A com.
1277. J. M. Carter, Monmouth—Harness and shafts of carriages.
1278. Alexander Prince, Trafalgar Square—Composition marble.—A com.
1279. Werner Staufen, George Street—Manufacture of brushes.
1280. J. L. Norton, Belle Sauvage Yard—Drying yarns.
1281. J. M. Napier, York Road—Projectiles.
1282. A. H. Fielden, Castle Street—Rainbow light.
1283. H. F. Broadwood, Great Pulteney Street—Pianofortes.
1284. Henry Willis, Albany Street—Valves.
1285. W. E. Newton, Chancery Lane—Lamps.—A com.
1286. W. T. Loy, Rood Lane—Carding cotton.—A com.

1*st May*, 1862.

1287. James Swallow and James Allinson, Heckmondwike—Carpet fabric.
1288. W. B. Smith and William Bennotts, Cornwall—Preventing the injurious effects occasioned by deleterious gases.
1289. C. P. A. Doucbain, St. Cloud, France—Shutting off liquids.
1290. Thomas Holmes, John Street—Military cartouches, &c.

2*d May*, 1862.

1291. W. and T. Huntington, Liverpool—Manufacture of bread.
1292. Hermann Khon, Berlin, Prussia—Waterproof fabrics.
1293. William Bodden and William Mercer, Oldham—Roving cotton.
1294. T. F. Griffiths, Birmingham—Shaping sheet iron.
1295. Robert Walker, Glasgow—Malting.
1296. O. C. Evans, Church Street—Converting reciprocating in rotary motion.
1297. O. C. Evans, Church Street—An abdominal truss.
1298. Charles Ashwell, Albany Road—Safety fastening.
1299. R. A. Brooman, Fleet Street—Superheating steam.—A com.
1300. C. F. Whitworth, Sowerby Bridge, York—Signalling.
1301. Matthew Paul, Dumbarton—Windlasses and capstans.
1302. J. W. Gill, Crediton, Devonshire—Pulverizing land.
1303. Henry Welch, Millwall—Attaching armour plates.
1304. A. V. Newton, Chancery Lane—Electrical apparatus.—A com.

3*d May*, 1862.

1305. William Mossman, Cleveland Terrace, Islington—Bonnets and hats.
1306. Joseph Brierley, Blackburn, Lancashire—Fire plugs or valves.
1307. Henri Juhel, Bordeaux, France—Wheels.—A com.
1308. Joseph Tyler, Kennington Place—Clarionets.
1309. Edward Omerod and Christian Schiele, Manchester—Dressing stones.
1310. H. G. Moffatt, Dalston—Advertizing medium.
1311. J. M. Herdevin and J. A. Jullien, Paris—Sluice cocks.
1312. Thomas Snowdon, Stockton-on-Tees—Melting of steel.—A com.
1313. J. H. Heppel, Great George Street—Permanent way of railways.
1314. John Herdman, Belfast, Antrim—Iron and steel plates.
1315. William Black, Northampton—Lottery and ballot boxes.
1316. George Neall, Islington—Motive power.
1317. Michael Henry, Fleet Street—Manufacture of paper.—A com.
1318. John Fowler, Leeds—Engines.
1319. Salvatore Merolla, Largo Castello, Naples—Fire arms.
1320. W. E. Newton, Chancery Lane—Joining boxes.—A com.
1321. J. and T. Mellodew, Oldham, and C. W. Kesselmeyer, Manchester—Looms.
1322. Charles Schlickeysen, Berlin, Prussia—Moulding bricks, &c.
1323. John Heyworth, Shawforth—Looms.
1324. P. V. Lefebvre, Paris—Self-feeding pen inkstand.

5*th May*, 1862.

1325. Alfred Williams, New Windsor—Table with seat or a desk.
1326. Thomas Parkinson, John Norman, and Richard Cottam, Blackburn—Furnaces.
1327. L. G. Perreaux, Paris—Clocks.
1328. Herbert Alluan, Bedford Row—Locks.
1329. Thomas Wilson, Birmingham—Armour plates.
1330. Samson Barnett, Farston Street—Helmets for divers.
1331. T. F. R. Brindley, Leonard Square—Flasks and bottles.
1332. Christopher Binks, Parliament Street—Hydrogen gas.
1333. Francois Marrel, Marseille, France—Wrought iron bars.
1334. J. Victor, Wadebridge, J. Polglase, Bodmin, and W. Roundsevell, St. Breock—Safety fuses.
1335. Robert Burley, Glasgow—Using ordnance under water.
1336. Robert Bushby, Little Hampton, Sussex—Lightening ships.
1337. James Roscoe, Leicester—Lubricator.
1338. P. L. A. T. Sourbe, Condom, France—Spirits and wines.
1339. E. B. Wilson, Parliament Street—Malleable iron and steel.
1340. J. H. Johnson, Middlesex and Glasgow—Steam generators.—A com.
1341. John Adcock, Marlborough Road—Measuring and indicating distances travelled by wheel carriages.
1342. Benjamin Cooke, Anthony—Implement for cutting turf.

6*th May*, 1862.

1343. Thomas Carbourg, Paris—Boots and shoes.
1344. Richard Mills, Bury—Washing machines.
1345. Augustin Morel, Roubaix, France—Heckling machines.
1346. George Borthwick, Bedford—Ships and boats.
1347. Paul Chenaillier, Paris—Concentrating liquids.
1348. John Clarke and John Richmond, Chilvers Coton—Looms.
1349. W. and J. Richard, Edinburgh—Printing types.
1350. J. H. Johnson, Middlesex and Glasgow—Minium or red lead.—A com.
1351. William Greaves, Portland Street—Safety stirrup bars.
1352. J. H. Johnson, Middlesex and Glasgow—Soda and potash.—A com.
1353. William Clark, Chancery Lane—Buckle or fastening.—A com.
1354. William Clark, Chancery Lane—Cylinder printing.—A com.
1355. J. E. Ransome, Wm. Copping, and Lawson Lansdell, Ipswich—Harrows.

7*th May*, 1862.

1356. W. E. Nethersole, Swansea—Railway trucks.
1357. William Judson, New York, U.S.—Caoutchouc or india-rubber applied to guns to resist the force of the recoil in firing.
1358. Eugine Bourdon, Paris—Blowing fans and centrifugal pumps.
1359. C. V. F. De Berville, Paris—Safety coupling bar.
1360. P. H Colomb, Devonport—Signalling.
1361. Thomas Markland, Hyde, Cheshire—Wearing apparel.
1362. T. H. Hopwood, Manchester—Raising sunken vessels.
1363. Charles Clark, City Road—Cigar tube.
1364. Nicholas Wood and Joseph Stockley, Newcastle—Polishing plate glass.
1365. Jeremiah Johnsou and Arthur Chapman, Leatherhead, Surrey—Preventing collisious on railways.
1366. R. A. Brooman, Fleet Street—Box for containing matebes.—A com.
1367. R. A. Brooman, Fleet Street—Swings.—A com.
1368. John Combe, Leeds—Spreading flax and hemp.
1369. G. T. Bousfield, Brixton—Tilling land.—A com.
1370. Joseph Haley, Rochester Villa—Boats and batteries.
1371. William Gossage, Widnes—Manufacture of soap.
1372. D. Marchal and A C. De Wiart, Brussels—Preventiug vibration on railways.
1373. John M'Cann, Dubliu—Drying grain.

8*th May*, 1862.

1374. John Hay, Troon—Repairing slips' bottoms.
1375. W. P. Gaulton and Major Booth, Manchester—Steaming fabrics.
1376. William Riddle, Gerrard Street—Hydraulic presses in treating cotton.
1377. Andrew Bearne, Torquay, Devonshire—Heels of boots.
1378. William Southwood, Kensington—Pulverizing ores.
1379. John Fowler, Leeds, and John King, Chadshunt—Tilling land.
1380. Peter Tate, South Street, Kennington—Furnaces.—A com.
1381. Charles Lungley, Deptford—Manœuvring vessels.
1382. G. C. Grimes, Wandsworth—Cigar lights.
1383. A. P. Price, Lincoln's Inn Fields—Straps or bands.
1384. Arthur Kinder, Cannon Street—Sheet metal
1385. L. De la Peyrouse, Panton Square—Treating compounds containing paraffin.
1386. Nathaniel Thompson, Birmingham—Barometers —A com.

9*th May*, 1862.

1387. G. F. Greiner and J. H. C. Sandilands, Golden Square—Pianofortes.
1388. Thomas M'Ilroy, Brampton, Canada West—Invalid bedstead.
1389. Leopold D'Aubreville, Paris—Sleepers for railways.—A com.
1390. T. K. Mace, Birmingham—Protectors for hats.
1391. William Eddington, Chelmsford—Grinding machinery.
1392. F. F. B. Mayall, Warrington—Dyeing.
1393. J. F. Bland, Dorset Square—Signalling between targets and shooters.
1394. Thomas Fawcett, Lisburn, Ireland—Plaited fabrics.
1395. James Oxley, Frome—Mashing and sparging in breweries.
1396. Thomas Welton, Grafton Street—Brewing.
1397. Nathaniel Symons, Cambridge Street—Wheels, girders, &c.
1398. F. J. Bolton, Bolton Row—Telegraphing.
1399. F. J. Boltou, Bolton Row—Light houses.

10*th May*, 1862.

1400. G. C. Haseler, Vittoria Street—Lockets.
1401. J. G. Willans, Belfast—Pig or cast iron.
1402. J. F. Milward, Redditch, Worcestershire—Fire-arms.—A com.
1403. William Clark, Chaucery Lane—Vegetable fibre.—A com.
1404. Robert Moore, Cannon Street West—Indicating the positiou of liquids, gases, or vapours.
1405. Robert Moore, Cannon Street West—Structure of vessels.
1406. J. T. Cooke, Leicester—Battens.
1407. Richard Willoughby, Mildmay Road—Exhibiting placards, &c.
1408. H. D. Taylor and Edward Robinson, Huddersfield—Piece-dyed fabrics.
1409. James House, Market Lavington, Wiltshire—Crushing substances.
1410. W. H. Ronald, Montrose—Signalling in rifle practice.
1411. Emerich Kolbenheyer, Vienna, Austria—Making ices.
1412. J. B. Cristofini, Paris—An improved tent.
1413. William Clark, Chancery Lane—Lamps.—A com.
1414. H. W. Sambidge, Birmingham—Gasaliers and lamps.

12*th May*, 1862.

1415. Henry Walker, Gresham Street—Handles for needles, pencils, &c.
1416. John Milnes, Gloucester—Exercising the human body.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 17th to 26th May, 1862.

May 17, 4481 James Aston, School of Musketry, Hythe—"Rotary Jug for Cleaning the Barrels of Rifles."
,, 26, 4482 John Hodgson, 29 Newmarket Street, Lincolnshire—"Plough"

PROGRESS OF THE EXHIBITION.

ART. III.

Few portions of the Exhibition will be seen with greater pleasure by the engineer, whether civil or mechanical, who is well up in the literature of his profession, than the 10th class of the French department. The objects exhibited under this class, that of "Civil Constructions," are principally shown in one space beneath the gallery, at the south-west corner of the Central Nave, and embrace five sub-classes, viz.—

1. Materials of construction, such as cements, plastering compositions, bricks, tiles, and artificial stones.
2. Models or designs of public works, properly so called, bridges of masonry or iron, viaducts, railways, canals for irrigation, graving docks, marine piers and other similar works, floating docks, light-houses, &c.
3. Works for the search for, and obtaining of, subterraneous water supplies, mineral or otherwise.
4. Works of public health or embellishment in cities—water supply, and the construction of sewerage.
5. Hydrological charts, and plans indicating relations of surface levelling.

Amongst these, evidences of a very impressive character will be found, of the vast advances that engineering science has made in France within the last few years, both in theory and practice.

The French jury charged with deciding as to the admission of objects for exhibition remark, in the preliminary observations of their national catalogue, as amongst the most remarkable advances of the last ten years in this class—

1. The more general application of calcareous cements, and the progress realised in their manufacture and modes of application.
2. The improvements that have been made in the methods of laying foundations in deep water.
3. The precision introduced in the fitting of great works in metals, the exactness of which admits of combinations of structural and of moveable parts, upon a scale impracticable upon the older methods of adjustment.
4. Improvements made in adjustable weirs (barrages mobiles), for river and other navigations, &c.
5. The improved knowledge as to the discovery and the obtaining of subterraneous supplies of water.

These are no doubt some of the heads under which French engineering may demand a high place in the school of arts of the world; but comprehensive as is each of these heads, and important as are the examples by which France shows its progress in each, they all by no means represent the amazing material progress that the nation has made in constructional science and practice, within a period scarcely thrice that which has elapsed since she first exhibited upon a foreign soil in 1851.

When the Revolution of 1830 overtook Charles the Tenth, and ignominiously drove from his capital and palace that last imbecile of the elder Bourbons, civil engineering in France was not greatly advanced beyond what it had been left by such men as Perronnet and Belidor, towards the close of the best, or at least the most splendid, period of that dynasty. There were no quite modern works in France, that exceeded in boldness of conception or skill of execution, many of those of these great old masters of their craft;—nothing in hydraulic masonry equal to the Lampy Reservoir and the Canal of Languedoc;—nothing so splendid in bridge building as the Pont de Neuilly, in striking the centring from under the large elliptic arches of which, Perronnet had provided so striking a pageant for the grand monarque and his court, and exhibited so singularly his own skill and daring—every arch from side to side of the wide Seine being, at the king's word, denuded of the vast complication of carpentry in the centring, and in a moment the whole of this, floating flat upon the river's face.

Even the attempts made from time to time to follow up to completion, some of the great works planned or begun in the Augustan age of the old monarchy, had shown that the engineering power of France had actually retrograded; thus the break-water at Cherbourg, fitfully continued, made but little progress.

The iron manufactures of France, stimulated by Napoleon the Great, had advanced more in proportion; and the examples that were erected in his time of iron bridges, &c., were never quite lost sight of even in the remote provinces. Suspension bridge building especially, had advanced a good deal, and some large structures had already spanned the great rivers of France. Some great stone bridges were in progress of erection, but after the old methods sanctioned by Vauban,—notably amongst which was that of Rouen, the piers of which were based upon huge mounds of "pierre perdú," thrown into the Seine, and largely obstructing its channel.

Lethargy sat heavy on France as respected public works or private enterprise, which peace long continued was unable to shake off, until the nation had freed itself from the last dry bones, of a dead and gone tyranny.

The convulsion by which she became free, however, for some years sadly interfered with, and palsied her energies for internal improvement—for all those advances of which great and successful public works are the sure indices, and in turn the truest auxiliaries.

About ten years later, long after Louis Philippe had got settled firmly (as it seemed) upon his throne, and when railways (the Havre and Rouen line in the first instance) began at last to be made; English contractors and English workmen were the actual executors. Very soon after the second railway of France was in progress, the fortification of Paris was decided upon. This was a work of a class pre-eminently French, in which all the traditions of its Corps de genie, from Turenne and Vauban, downwards to Napoleon, might have given assurance that French engineers and French "Cuviers" would have found themselves at home, and could have been excelled by none, in the rapidity of their methods, and the goodness of their execution, of these vast earthworks and faces of masonry designed with the accustomed military science of France.

The difficult political position of the king and his supporters urged the pushing on with every possible dispatch, the highly unpopular measure of the "Forts detachés," and the "enciente continue," but the works were begun, continued, urged; and yet little or no progress was made with earthworks, conducted by men and women carrying baskets of stuff upon their heads or shoulders; and even the populace of Paris began to laugh at the enormous disparity between the huge lines traced out, and the means employed to realize them. In this state of things, Wm. Mackenzie, the English Railway Contractor, who, with his sturdy corps of English navvys, had already amazed the provincials of Normandy, as he sliced up their fertile soil, appeared upon the scene. He asked for an audience of the king, told him his fortifications, as they then went, would not be finished by the time his grandson should be a gray haired man, and offered to undertake all or any portion of the work, binding himself as to the day of execution. His offer was accepted after a time, and he undertook large sections of the works around Paris, at contract prices that seemed so small to the French Military Engineers as to be utterly impossible to be abided by, but which in reality resulted in a fortune to the contractor.

To Wm. Mackenzie's earliest works in France must be ascribed—however tardily, perhaps, Frenchmen be disposed to admit it—the first great stimulus that roused into action and energy the dormant engineering powers of the nation.

It would be out of place here to pursue this sketch of a fragment of French Engineering History. How great is the change that the last twenty years have witnessed?

Her own engineers and navvys now make her railways, designed and executed at least as well as any in the world. Her stone masons may

point to such works as Roquefavour aqueduct, rivalling in magnitude the greatest Roman works of the sort, and far excelling any of them in skilful proportions, although itself not quite free from some defects.

She may with just pride exhibit the underground construction, as well as the architectural facade of her new streets in Paris, and a very few in one or two of her great provincial towns, as in advance of all the world—and can, with a lofty satisfaction, now regard the completion of the vast marine works of her ports, left unfinished or unattempted in former times—and see that English Harbour Engineers have now followed the practice she was the first to employ upon a great scale, in the construction of Marine moles, with huge blocks of artificial stone, such as at those adopted at Marseilles and Algiers.

Amongst the many beautifully executed models which are exhibited is one (No. 1251) of a fragment of the Jetty of the Napoleon Basin of the harbour of Marseilles. It shows the progress of the work stage by stage, from the sea bottom in pretty deep water, upwards, to the crests of the parapets on top, together with the main apparatus in floating sheer legs, barges, cranes, &c., &c., employed in transporting and setting under or above water, the immense blocks of Bêton, of which the work is mainly constructed. MM. Paseal and André, the former the engineer in chief, and Mr Dussaud, the contractor, are the names given in connection with the work, but the models, as are in fact all those of public works here, are really exhibited by the ministry of agriculture, commerce, and public works. It is a remarkable fact, that in a country abounding as does the Mediterranean French coast with limestone of the finest quality going sheer down everywhere into the sea—the formation of artificial blocks of stone or béton should be found more economical, than obtaining the material from the natural quarry. The blocks used at Marseilles are very large, and it is understood that still larger blocks, weighing as much as twenty tons each, have been used at Algiers.

At Holyhead harbour, the size of block employed is only a parallelopiped of 8 feet × 3 ft. × 3 ft. Each block is built up in a wooden, dissecting frame; and two rectangular holes are formed right through each block for lifting it by T-ended lewis bars free from any risk of injury or fracture.

The cost of one such block at Holyhead is about as follows:—

	s.	d.
1½ tons of rubble stone, quarried at 2s 6d, . . .	3	9
10 cubic feet Portland cement, at 1s, ...	10	0
Labour in building up the block in mould, at per cub. yard, piece work, ...	3	6
Floor space, stacking up, and drying (4 months), .	2	0
	19	3

which is for 72 cub. feet of artificial stone, or a little under 3¼d per cub. foot.

Some of the blocks there have been tried with Portland cement and sand; others, with ground lime mortar of Halkinhead lime, which it is said gives, after sufficient time has been allowed for setting, almost as good results.

Probably, the most remarkable swivel bridge in the world is exhibited here (No. 1251-8); that designed for the port of Brest by MM. Cadiat and Oudry, and executed at the works of Creuzot. It is a balanced, horizontal, double-leaved swivel or turning bridge, taking common road heavy traffic across the Penfeld at a height sufficient to allow ordinary small-masted vessels to pass beneath without opening—the last being only required for large ships. The span exceeds by more than threefold the largest swivel bridge in the United Kingdom. It is a combination of trellis and boiler-plate work, and presents great boldness, and a great deal of skill in design.

Another entire class of works, that of moveable or adjustable weirs or dams (barrages mobiles), is largely represented in this class, as in (No. 1251-10-11-12). Adjustable dams are very little known amongst us, nearly indeed unknown in England proper, where the rivers neither have the rapid fall, nor are usually exposed to the meteorological conditions that produce the sudden and destructive floods which make these works important in France.

In the South of France especially, these constructions are important and well understood; the rivers and their secondary feeders are all, more or less, torrential; the south-western slope of the Alps impresses upon them their rapid fall, and the *quasi* tropical character of the climate causes tremendous rainfalls at times, and yet the necessity, during others of arid drought, for carefully husbanding the water for agricultural and manufacturing uses. Hence the great skill with which French engineers have adapted to the crests of their weirs, raising and lowering obstacles, usually of timber mounted in iron, and so arranged, that as soon as the water ponded up above the weir, reaches a certain height, these top-boards drop by automatic action, fall down flat, and permit the flood waters to escape over them unimpeded. The devices by which this is accomplished are various, and we can here only direct our readers' attention to some of those exhibited.

In the United States, like contrivances have been found needful; but amongst many there employed, that particular construction known as "The bear trap sluice" has long been considered the favourite.

The only part of the United Kingdom in which these adjustable dams have been employed, upon a great scale, is in Ireland, in some of the works designed under the guidance of Mr William F. Mulvany, C.E, while Commissioner of Arterial Drainage. Some works of the sort, upon a minor scale, exist in Yorkshire and in Scotland.

Perhaps the very simplest and most effectual adjustable dam is the peculiar form of syphon dam, designed for the Irish Drainage Commissioners by Mr R. Mallet, and to which the late Sir William Cubitt gave his unqualified recommendation. Some account of it will be found in Weale's quarterly papers on engineering of some years back.

There are also some good examples of lattice bridge building shown, especially (No. 1251-33-34-35).

The magnificent maps exhibited by the French government, such as the atlas of the surface levelling of France, executed under the direction of the Administration des Ponts et Chaussés (No. 18), the geological map of departments, the agronomie map of the arrondisement of Toul (Meurthe), and the mining maps of coal basins, are worthy of careful examination, as are still more so, the albums of photographs of great works in various stages of progress, exhibited with many of the models. A map of underground Paris, showing the sewers and water distribution, has even a popular interest.

There are many French light-houses exhibited. In all of these we trace the stamp of the originality of our own Smeaton's genius—all are copies, near or remote, of the Eddystone. In the origination of the dioptric methods of illumination of Fresnel, however, France has again asserted the import and effect of the possession of exact science upon her engineering works. It is impossible to notice at present, however briefly, even a tolerably large fraction of the works exhibited in this interesting court. We must revert to them in a future part.

On the 11th of July, as these sentences pass through the press, the jury awards have been declared, with all due pomp and ceremony, within the Exhibition building and the beautiful Horticultural Garden adjoining it. It is needless for us to repeat the circumstances of this the most perfectly successful fête that the Commissioners have attempted—these have been, ere our pages appear, well told by the daily journals.

In every way, the ceremony was a vast improvement upon the bad taste in so many ways displayed at the opening. In none more so than in the absence of the hideous bale bars, at 10 or 12 feet apart, between which the procession then marched, and in now defining and securely fencing in its line of route on both sides, by a triple or quadruple rank of seated women—the perspective of whose bright faces, and hardly less brilliant dresses, was eminently striking and beautiful, as we beheld it from the descent of either däis.

One thought, however, forced itself upon our minds. There is a want of dignity in all this peripatetic work. The conferring of the medals in 1855, in Paris, was a far more august and dignified proceeding, when the vast throng were all calmly *seated*—filling an enormous parallelogram-shaped amphitheatre within the building, and all eyes directed

towards the one centre—the throne, to which the awards were brought, and whence, as from its proper fountain, the honours descended on those nominated for them. On the 11th it seemed rather hard to make out what all the walking about was for, and the long pilgrimages made to the hands and "stations."

About 7000 medals have been awarded in all, and about 5000 honourable mentions made, amongst a total of about 25,000 exhibitors. The award books, though at this date (the 12th July) a few have been produced and sold or distributed, can scarcely be said to be as yet published.

That the great mass of the awards will prove substantially just, in a positive sense, we have little doubt; but in a negative one, we have reason to believe that very great injustice has, in several instances, been done; that, owing to the haste and confusion with which preliminary arrangements were conducted in the Commissioners' offices, and in the reception and distribution of objects, and in the cataloguing of them, many highly meritorious works, inventions, and products, have been misplaced, or so muddled up as to have been passed over, in the consideration of awards, altogether, or disqualified, from such considerations, on technical grounds only. Complaints, as regards the injured parties, are vain now, and of no use but with a view to a warning for a possible future Exhibition, when it will probably have been forgotten.—Ed.

REGENERATIVE GAS ENGINE.

C. W. & F. Siemens, Engineers.—*Illustrated by Plate* 290.

In our current part we give a copperplate of Mr Chas. W. Siemens', C.E., gas engine, and expected to have accompanied it with a sufficient description and some remarks.

Owing to the pressure of his other engagements we have been, at the last moment, disappointed by not receiving the requisite information from Mr Siemens, and as we are unwilling to produce anything incomplet on such a subject, we prefer postponing until our approaching part in September all notice of the particulars of this engine. Full information as to which Mr Siemens, the inventor, has undertaken to supply to us in the interval.—Ed.

KAMPTULICON.

The material which bears this odd-looking name, and is the subject of several patents, has come into extensive use of late years, for very different purposes. It is a compound of gutta percha, caoutchouc, and cork, ground into fine particles, and then intimately mixed and subjected to great pressure. Messrs Taylor, Harry & Co., of 19 Gutter Lane, Cheapside, are the principal manufacturers of it; and their establishment at Deptford, where the manufacture is carried on, is on a large scale. In the Great Exhibition, they have deposited many examples of its various applications; and they have a case (No. 1136, Eastern Annex) in which they exhibit the materials employed, and the stages of the manufacture. All the materials are well-known substances; but with respect to the cork, it may be mentioned that it is the refuse of the cork cutters which is employed. Formerly, this refuse was thrown away as useless, but now a great demand has sprung up for it, so that the price has gradually advanced until it is now £7 10s a ton. About 300 tons a year are purchased for this manufacture, and the supply is not equal to the demand. The entire manufacture, from the treatment of the native gums to the completion of the finished material by the application of oil colours, is conducted at Deptford; and we are informed that the entire process does not occupy more than ten hours. A considerable time, however, is required for seasoning it before it is fit to use as a floor-cloth. There has been a very extensive call for the manufactured article to be laid down on floors, where it wears very well, and gives back no noise to the step. It has been laid down in the Houses of Parliament, in many public offices, churches, hotels, and club-houses. For this purpose, it has been ornamented with various patterns, one of which is illustrated on this page by a woodcut. Several ornamental designs may be seen in the Exhibition. The designs are such as will leave the original surface as much as possible exposed. It then affords a degree of warmth intermediate between an oil-cloth and a carpet. The advantages derived from its use are, that it is unaffected with damp, is a non-conductor of heat, and is a deadener of sound.

It has also come into use for the cells of lunatics; the walls and floors being covered with kamptulicon, of from half an inch to one inch in thickness, the resilience of the material prevents the inmates doing themselves any personal injury; while, from its being a non-conductor of heat, it conduces to the maintenance of an equable temperature. It has been adopted for many years at Bethlehem Hospital, and some other asylums. It is also of great service for lining the boxes or covering the backs of the stalls of kicking horses. By deadening the sounds of the blows it has a great tendency to cure this vicious habit; while, by its elasticity, it prevents injury to the horse itself. It is used in the Royal stables and elsewhere. It also makes a good floor for riding schools, preventing noise, lessening the shock in the case of a fall, and preserving the feet of the horses from the concussion of hard pavement. Another of its manifold uses is as a covering for knife-cleaners, for which it possesses all the advantages of leather at about one-fourth the cost. It is estimated that from forty to fifty thousand of these knife-boards are made and sold per annum.

HYDRAULIC GUN MOUNTING.

In our remarks in the last part upon Mr Mallet's method of hydraulic mounting, we stated that the 12 ton gun of Sir Wm. Armstrong, when fired against Mr Scott Russell's target at Shoeburyness lately, required about 100 artillerymen with handspikes and side tackles to train the gun, and that they did so with difficulty and much loss of time. We have since been favoured by a distinguished officer stationed there with a private note, which mentions that the gun on the day in question, was fired "from its carriage but without a platform," which accounted for the great difficulty in its being worked; and, it is added, that when on its platform the ordinary gun detachment of ten men worked it with perfect ease. We refer to the statement here, as we should not wish even in appearance to present a partial or erroneous statement. Ten men *may*, work with perfect ease a gun of 22 tons weight—"slow and sure," perhaps—but if the *ordinary* detachment of 10 men be *only* sufficient for the ordinary 68 pounder of 5 tons to which the number is proportioned, how is it they are still sufficient for a gun of more than four times the weight, and where is the sufficiency of the ordinary 10 men to stop? We presume, with all the "perfect ease" with which the 22 ton gun was worked

when on its platform, that it was worked at a "snail's pace;" but whether this be so or not, the arguments adduced by Mr Mallet as to the increasing importance of *rapid fire* from all heavy guns remain perfectly untouched, and of these our reference to the working of the gun at Shoeburyness was only in illustration.—Ed.

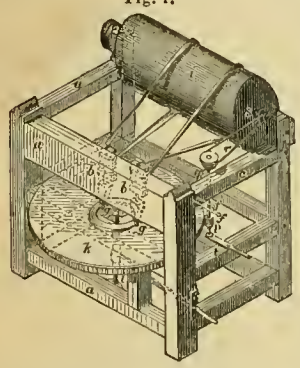
MANUFACTURE OF PICTURE FRAMES BY MACHINERY.

The machinery which we are about to describe has been applied with great success to the manufacture and enamelling of picture frames by Mr Robert Marcher of New York, and communicated by him to Mr J. H. Johnson of Loudon and Glasgow, in whose name British and Continental patents have been obtained.

The first part of the improvements comprehend the arrangement of the mechanism for cutting irregular forms in wood. This mechanism is arranged on the principle of the pentagraph; a pattern being fastened to a table, rollers or tracers are caused to traverse over the surface of the pattern, and those tracers being connected to suitable cutters which revolve at a high velocity, the block under operation is thereby turned so as to form an exact counterpart of the pattern. In this way picture frames can be produced with great rapidity and economy. The second part of the invention consists of an apparatus for coating or enamelling lengths of moulding intended for pictures or other generally similar purposes. The third part of these improvements comprehends a machine for preparing and enamelling picture frames of an oval figure, by means of which an exceedingly neat and well finished frame is obtained. This invention is admirably adapted to supply the immense demand for frames which Photography, Art Unions, and the daily increasing taste for engravings give rise to.

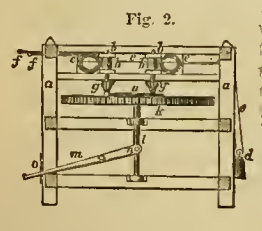
Fig. 1 of the accompanying engravings is a perspective view of the machine, and fig. 2 is a vertical section of the same. *a* represents the frame or standard, *b* two vertical and parallel shafts, the journals of which run in bearings mounted in carriages, *c*, one for each shaft, the said carriages being adapted to slide horizontally in suitable guideways in the frame. By means of a weight, *d*, and a cord, *e*, the two carriages, *c c*, are drawn or forced in one direction, and hence tend constantly to move in that direction, so that either or both of them will yield when required in the opposite direction, or they may be drawn away by means of the rod, *f*, when required.

Fig. 1.



Each of the said shafts, *b*, is provided at its lower end with a roller or tracer, *g*, and above the rollers, with suitable cutters the reverse of the form of the mouldings or configuration desired to be produced, the cutters on one being adapted to the moulding or form desired to be given to the outer periphery of the frame to be produced, whilst those on the other are adapted to the inner periphery, including the under rebate to receive the glass or picture, if applied to making picture frames. The cutter shafts are each provided with a pulley, *h*, which receives motion by means of a belt driven from the drum, *i*, on the driving shaft. Below the lower end of the cutter shafts, *b*, there is a circular table, *k*, connected with the upper end of a vertical shaft, *l*, which is adapted to slide vertically in suitable bearings in the frame, *a*. The table is held at the required elevation, or is elevated or depressed at the will of the attendant by a hand lever, *m*, connected with the shaft. If the table be connected with the upper end of this shaft so as to turn thereon, the lever, *m*, may be connected with the shaft by a pin, *n*; but if the table be secured to the shaft so as to turn with it, then the connection of the lever should be by a suitable collar. The table is held at the required elevation by a notched plate, *o*. The circular periphery of the table is toothed, and receives a slow rotary motion from a pinion, *p*, on a vertical shaft, *q*, which shaft receives motion by a belt, *r*, from a pulley, *s*, on the driving shaft, or by other suitable means.

Fig. 2.



The lower end of the pinion shaft is pivoted in one end of a lever, *t*, so that the pinion may be engaged with, or disengaged from, the teeth of the table.

A pattern, *u*, of an oval, or any other form to be produced, is secured to the upper surface of the table, and the rough frame or block of wood termed a "blank," and previously made of a configuration approximating generally to the form desired to be produced, is secured by suitable means to the pattern or to the table, but in such relations to the pattern that it may receive the action of the cutters whilst the rollers on the cutter shafts bear against the pattern.

In attaching a blank, the table is lowered by the attendant, and after properly securing the block, the cutter shafts are drawn away against the force of the weights, *d*, or other equivalent, such as springs, by means of the rods, *f*, and so soon as the table is brought to the required elevation, the pinion, *p*, is thrown into gear therewith so as to impart to it a slow rotary motion. The cutters, which rotate at a high velocity, are then liberated by the attendant, and are brought into action by the weights, *d*, one of the said cutters acting against the inner, and the other against the outer periphery of the blank, which is gradually cut away until the tracing rollers, *g*, on the shafts are brought to bear against the inner and outer peripheries of the pattern, which is thus made to act as a gauge and guide during the circuit, the cutters being pressed against the material to be cut remove the wood until the tracing rollers come into contact with the pattern, and as the table with the pattern and blank rotates slowly, whilst the cutters rotate at a higher velocity, it follows that at the end of each entire revolution the frame or block will be reduced to the required configuration, both upon the inner and outer periphery, and upon the entire face, if the cutters be properly shaped as being situated on opposite sides of the axis of the blank, the cut of the one set of cutters may come up to or overlap the cut of the other set without conflicting with each other, which could not be done if the two sets of cutters were arranged on the same side of the axis of the pattern.

The cutters may be so formed as to cut under as well as on the face of the blank, and thereby form a rebate to receive a picture or looking-glass, in making frames for such purposes, or to make a moulding of any kind which may be required to extend to the under surface.

By means of the rotary motion of the table with the pattern, or equivalent circuit, and the sliding or lateral motion, any form of frame can be cut automatically, and with accuracy, and by the employment of two shafts with cutters and tracers, one or both of which are made self-adjusting as regards distance, the tracers and cutters are rendered self-adjusting to any width of the pattern. By having the two cutters on opposite sides of the axis of the pattern, one inside and the other out, both the inner and the outer periphery can be cut at the same time, and yet admit of using cutters to cut on the under as well as the upper surface, and over the entire surface.

Fig. 3 of the accompanying engravings represents a perspective view of the enamelling apparatus, and fig. 4 is a transverse vertical section of the same. A represents a table or bench of a length sufficient to receive the mouldings, or other articles to be enamelled, the said bench being provided with two parallel ways, the upper surface of one being formed with a groove to receive and guide a tongue attached to the apparatus for laying the composition. This apparatus, represented at B, consists of a carriage for carrying the composition, such as is used for enamelling, having the top and bottom open, and the two ends cut out to a sufficient extent to receive the largest mouldings which may be required to be enamelled. The lower part of the sides terminate in flanges, *b*, which rest on the ways, one of them having an angular guide-piece projecting from its under face. Within this carriage there is a box or hopper, C, of nearly the same length as the inside, but narrower, and with the top and bottom open. It can be raised or lowered, and moved to one side or the other, as may be required, by means of adjusting screws, *c*, tapped into the sides of the carriage, the ends of which grip the sides, so that, by turning these screws, the box or hopper can be liberated for adjustment, and then firmly held in position. The two sides of this hopper are generally of unequal width, one being deeper than the other, and there should be several of them to suit different sized mouldings. The bottom edges of the two sides terminate in flanges, *d*, extending below the moulding, one under the rebate, and the other under the inner edge of the moulding, as represented. There are two plates, D, of sufficient width to fit in the ends of the carriage, so as to slide up and down freely, but yet making a close fit between the ends of the box, C, and the ends of the carriage, B. The lower edge of these plates is of a form

Fig. 3.

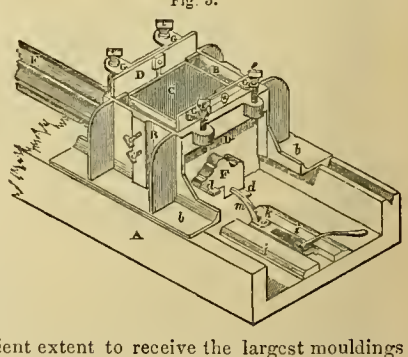
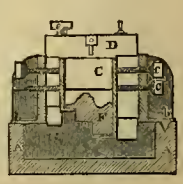


Fig. 4.

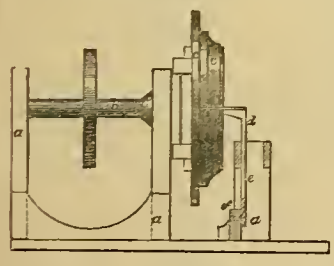


the reverse of the moulding to be coated or enamelled, there being one set of such plates for each kind of moulding. These plates are adjustable towards and from the surface of the moulding, by means of set screws, *e*, tapped into the ends of the carriage, and formed with collars to embrace the snugs, *g*, projecting from the upper ends of the plates.

A length of moulding, F, is secured in place above the table, A, by means of suitable "dogs." At one end the "dogs" may be permanent, but at the other they are adjustable. Two pieces, *i*, are attached to the top of the table forming a dove-tail groove between them, to which is fitted a sliding piece, *k*, forked at its rear end. The "dog," *m*, is attached to the sliding piece, *k*, and its forward end is suitably formed to hold the moulding when driven into it. After the moulding has been driven against the stationary "dog" at the other end, the "dog," *m*, is driven in, and held firmly in place by a wedge forced between the forks of the slide, *k*, so as to press it outward against the sides of the dove-tail groove, and to hold the "dog" firmly in place. The moulding to be enamelled being secured in its place, and the carriage brought to one end, the plates, n, are set by the screws, *e*, so as to press lightly upon the moulding, whilst the carriage rests on the ways, there being sufficient space left between the flanges, *d*, and the under part of the moulding to allow for the intended thickness of the enamel to be put on the upper, or moulding surface. The composition to be applied is put in the box or hopper, C, in a semi-fluid condition, and is prevented from running out at the bottom by the surface of the moulding, at the sides of the hopper, C, and at the ends by the plates, n, which form the ends of the hopper. The carriage is then moved forward to the other end of the moulding, and as the surface of the moulding constitutes the bottom of the hopper, the semi-liquid material coats in succession every part of the surface. The lower edge of the plate, D, which, before starting, was set in contact with the surface of the moulding when in motion, determines the thickness of the coat of enamel to be left on the surface of the moulding. As the carriage with all its appendages is simply held down by gravity, and the lower edge of the plate, n, simply rests on the surface of the moulding by gravity, and as there is sufficient play left between the under surface of the moulding and the flanges, *d*, of the hopper, the whole is permitted to rise as the edge of the plate, D, meets with the resistance presented by the adhesion of the coating of enamel on the surface of the moulding, and this it is that determines the thickness of the coating left. The passage of the edge of the plate, n, not only equalizes the thickness of the coating, but smooths the surface, and as it rests on the surface by gravity alone, it accommodates itself to any irregularity in the surface of the moulding, whether longitudinal or transverse, as it is moved from end so end. To fill up all the pores of the wood, and to obtain a smooth surface, suitable for gilding, or for other purposes, it is necessary to apply several coats of the composition, which is done by repeating the operation.

Fig. 5 is a side elevation of the improved machine for preparing oval picture frames, and fig. 6 is a front elevation thereof.

Fig. 5.

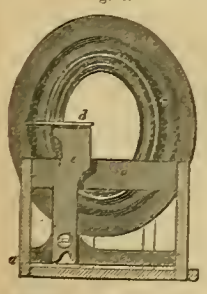


a represents a suitable frame in which is mounted a mandrel, *b*, with a face plate, *c*, to which an oval frame, c^1, of any kind may be properly secured.

The face plate, *c*, is connected with the mandrel in the usual manner for turning ovals.

A scraper or shaping tool, sometimes called a working-down tool, *d*, by preference made of metal, is formed with its working edge the reverse of the intended moulding, and this is secured to the upper end of an arm, *e*, which is attached by a screw, or otherwise pivoted at its lower end to a rocking shaft mounted in the frame at *f*, so that the working edge of the scraper is held to the face of the moulding, and is thereby rendered self-adapting to slight inequalties of the moulding as it rotates with the face plate, whilst at the same time it is held to its work by the pressure of the hands of the attendant. In lieu of this arrangement, the scraper may be attached to the upper end of a spring, the lower end of which is pivoted, or otherwise secured to the frame, so as to be free to yield to slight inequalities.

Fig. 6.



The cement used for enamelling having been applied to the surface of the moulding, the mandrel is set in motion and the scraper applied, by means of which, and the elliptical movement of the lathe, every part of the circuit of the frame is made to pass so as to be acted upon by the scraper to work down the enamel, the scraper yielding to any inequality in the surface.

THE GREAT AGRICULTURAL SHOW.—TRIAL OF THE STEAM PLOUGHS.

These trials took place beyond Farningham, and were not witnessed by very many.

They presented nothing of decisive novelty, but showed very many of those small yet effective takings off of "hitches" and difficulties that invariably mark the progress of every great invention, from its first realization to its full perfection. In the following will be found extracted most of what was note-worthy on this occasion. The steam plough is now everywhere drawn by a wire rope, set in motion by an engine, fixed or moveable, at one boundary of the field, one invention differing from another in the mode of working the rope and in the form of implement used.

On the summit of a hill, about two miles from the station, one of Aveling's engines was employed as a stationary power, driving by endless belt the alternately coiling and paying out drums of a fixed windlass, the ropes laid round the field by pulleys anchored at the corners, and hauling a couple of Kentish turnwrist ploughs, one a little forwarder than the other, on Mr Evenden's plan. Each of these strange-looking but exceedingly efficient implements was held by one man, and its fore-carriage guided by another, making four men to the two ploughs—the entire force, including windlass, anchor, and enginemen, consisting of eight men and one boy; but another boy is needed to shift the rope-porters more expeditiously. All this labour was bestowed upon the execution of only two furrows; Fowler's machine ploughing twice the number of furrows with three men and two boys. To waste of labour must be added loss of time. The turning of the implements at the end of the field occupied one minute, instead of less than a quarter of a minute, as in the working of other machines.

In the same locality, and on a piece of exceedingly rough land, Mr Smith, of Woolston, was working his original cultivating implement, which "smashes up" the ground without inverting the sod, thus enabling the weeds to be readily eradicated. The common portable engine and coiling windlass are stationary, the ropes being led round the field, and the anchored pulley at each end of the work shifted along the headland at intervals by a man digging holes, and removing the strong clawed grapnel into its next holding place. Mr Smith also showed the operation of his new combined implement, which grubs up a seed-bed, deposits and covers in the seed at one stroke; and he has brought out a very handy rope porter, which cannot be upset, and is very readily removed from under the rope just in front of the advancing implement, and quickly replaced behind it.

Close by was Messrs Taker & Sons' new stationary windlass, driven by an ordinary engine, and working with ropes, &c., one of Fowler's ploughs. In this windlass the two drums have a rigger, or smooth wheel, between them, hung upon the same single axis, and driven by the engine strap; the rapidly revolving rigger actuating the slowly rotating drums alternately by means of pinions and toothed wheels contained within the drums themselves—an arrangement securing a light machine, and the advantage of not having to stop the engine at every bout of the implement.

In another trial field, Messrs Brown & Way displayed their new stationary windlass, working on the Woolston principle, the machine being much lightened in construction; and here also Mr Williams exhibited his cultivating implements—one uniting the roller, heavy-toothed dray, light harrow, and chain harrow in one huge tool, to make a complete tilth at one operation.

Nearer the station was working Messrs Coleman's new apparatus, patented by Messrs Yarrow & Hilditch. The engine travels at intervals along the headland, keeping opposite one end of the furrow, and hauls a couple of wire ropes by two drums attached to the side of the boiler. The ropes run parallel across the field to two separate implements, one of which is in work while the other is running empty backwards for a fresh furrow. That part of the rope which takes the implements backwards is, of course, very light, and the anchorage for the pulley is very light indeed, and is shifted by hand when required. The time lost at the ends is in this apparatus reduced to about 10 or 12 seconds. The labour is that of five men, and two boys for shifting the rope porters.

In all the above sets of machinery, though the ropes are to some extent supported upon the small frames with friction rollers, called rope-porters, the slack or return ply of rope is left to trail more or less upon the ground. But as a rope sledging upon the land takes about ten times the draught that will move the same rope over rope-porters, both Mr Fowler and Messrs Howard have learnt to carry their rope properly, and thus not only save wear (hitherto an unfavourable item in the cost of steam culture), but also apply a larger per centage of the engine power to the implement. Messrs Howards' windlass is a fixture alongside a common portable engine, at the corner of the plot to be ploughed; motion being communicated to the windlass pinions and drums by a connecting spindle with universal joints. The ropes from the two winding drums lead partly round two pulleys or grooved wheels upon a frame, thence diverging to anchored pulleys at the corners of the field,

which are shifted when required by manual labour. In order to tighten the outgoing or tail rope sufficiently to bear it off the ground (held up as the rope is at intervals by rope-porters 3½ feet in height), it was requisite to put a retarding strain upon it, without consuming motive power in friction; and this has been effected with extreme simplicity and ingenuity by placing a third pulley-wheel between the two pulleys on the above-mentioned frame, in such a position that both the pulling and the outgoing, or slack, ropes are nipped against it, the one being thus suffered to pass out only with the same speed as that of the other, and hence the retarding strain upon the one is made an accelerating strain upon the other. There is no perceptible slip, although only a small amount of frictional break action is applied to the uncoiling drum, and the rope is well carried off the land; if there be a disadvantage in the compensation pulleys, it is in the probably increased wear by sharp bending of the ropes. The new rope-porters are a great improvement, the friction-rollers being dropped from beneath the rope, and the porter shifted in an instant.

Both Howard's and Fowler's implements are capable of good work, and there was great depth and thoroughness in the grubbing, trenching, so-called "digging," and again in the clean, smooth furrow-slice ploughing. The extraordinary cheapness of the processes, in comparison with horse-power operations, was sufficiently established by the Leeds trial last year. Mr Fowler has not rested in his progress. He has brought out a stationary windlass with coiling drums, holding the slack rope tight enough by a perfectly self-acting compensation break, by which little power is lost by friction; this is not the machine exhibited at the Christmas show, but one constructed with the drums on a vertical axis, enabling the ropes to run at once towards any quarter of the field. Mr Fowler prefers having the engine nearer its work, and the rope as short as may be practicable: for these purposes moving the engine at intervals along one headland, opposite to a self-moving anchorage-pulley on the other, the implement traversing to and fro between them. The large locomotive engine, with the clip-drum beneath it, which grasps and gives motion to the rope without coiling, is the machine for celerity of execution, and best adapted for large farms; but to give smaller occupations a chance of profitably employing the ordinary eight or ten horse portable engines now so plentiful throughout the country, a new and simple apparatus has been devised. One of the self-moving anchorages is furnished with a clip-drum in place of the pulley, placed on the headland in advance of a common engine, and driven by a novel kind of band or chain which will not slip, no matter how loose it may be, and heedless of the relative positions of the groove sheaves in which it runs. The iron links of this chain are faced on each side with folds of leather, and the wear is said to be very moderate. We have doubts, however, of how it may be found to answer in mud and wet weather.

On the whole, this climax of the implement department of the Battersea Park agricultural show, proves perhaps more fully than heretofore, how steadily and rapidly the advance is being made to a period at which horse labour for tilling the land, as well as for garnering its produce, will become greatly curtailed, if not abandoned, over all the outspread plains of our corn lands.

NEW BRIDGE OF BLACKFRIARS, LONDON.

This matter, which has been for years, from time to time, under discussion, from the time now almost historical, when Messrs Walker and Burgess completed their work of restoration of the bridge, by finding it needful to prop up with centring of timber two of the middle arches, to keep the whole structure from toppling into the Thames; has, at the last phase of its career, been decided with the summary rapidity, and in the unexpected way that is often remarked at the end of a long procrastinated project. Within the past month, the Bridge-house Estates Committee of the Corporation of London, to whom the question had been twice referred for consideration, eventually determined to recommend that the bridge to be erected by the corporation should be one of five arches springing from an abutment in a line with the present wharf lines on each side of the river. Having regard to the length of time that would necessarily be occupied in the construction of a stone bridge, as compared with one of iron arches, and to the very great difference between the cost of a stone bridge and that of an iron one, the committee were of opinion that it would not be desirable to adopt a design for a stone bridge. Of sixteen designs submitted to them by engineers of eminence they selected five, each of five arches, as best calculated to meet the requirements of the public—namely, stating them alphabetically, as the committee had done, the design of Mr James Brunlees for a bridge of five elliptical arches, at the estimated cost of £230,573, including the cost of a temporary bridge; the design of Mr Joseph Cubitt for a bridge of five segmental arches, at the estimated cost of £265,000; the design of Mr John Fowler for a bridge of five elliptical arches, at the estimated cost of £280,000; the design of Mr Robert Mylne, for a bridge of five segmental arches, at the estimated cost of £308,000, exclusive of a temporary bridge and the reconstruction of the outlet of the Fleet sewer; the design of Mr Thomas Page, for a bridge of five segmental arches, at the estimated cost of £260,000, including allowance for contingencies and for removing the present bridge.

These designs the committee presented yesterday, with an accompanying report, to the Common Council, for them to choose one for adoption. Pictorial representations of the selected designs were exhibited in the Council-chamber, and sketches of the unaccepted ones were shown in the adjoining committee rooms. Mr Brunlees' design had a centre arch of 209 ft. 4 in. span, side arches of 196 ft. 6 in., and abutment arches of 163 ft. 4 in. The headway of the centre arch above Trinity highwater mark was 26 ft., the distance from abutment to abutment 995 ft., and the available waterway for navigation 929 ft. The average gradient of the bridge was 1 in 50, with 70 ft. breadth of way. In Mr Cubitt's design, the span of the centre arch was 189 ft., of the side arches 176 ft., and of the abutment arches 164 ft. The headway of the centre arch was 27 ft. above highwater, the distance from abutment to abutment 963 ft., and the available waterway 869 ft. The breadth was 75 ft., and the steepest inclination of the bridge was 1 in 40. Mr Fowler's centre arch was 184 ft. in span, two side arches 173 ft. each, and two side arches of 162 feet. The headway of the centre arch above highwater mark was 22 ft., the distance from abutment to abutment 925 ft., and the available waterway 854 ft. The gradient of the bridge was 1 in 50, and the breadth 80 ft. The centre arch of Mr Mylne was 216 ft. span, the side arches 199 ft., and the two land arches 156 ft.; the headway of the centre arch being 26 ft., the distance between the abutments 987 ft., and the available waterway 926 ft. The span of Mr Page's centre arch was 200 ft., of the adjoining arches 188 ft., and of the abutment arches 164 ft. The headway of the centre arch above highwater was 23 ft., the distance between the abutments being 994 ft., and the available waterway 903 ft. The breadth of the bridge was not less than 75 ft., and the gradient was 1 in 50 on the Middlesex, and 1 in 40 on the Surrey side.

Mr Wellington Vallance, chairman of the Bridge-house Committee, in moving the adoption of their report, explained that the designs sent in to the committees were all by men of such undoubted eminence that it had been truly said the Court could scarcely err by selecting any one of them. With regard to the question of cost he was enabled to state, on the authority of the Chamberlain, that the Council need have no hesitation in adopting any design for a bridge, the estimated cost of which was not more than £300,000, and that they might even go further to the extent of an additional sum of £50,000 or £70,000. Much debate upon the report, and on the work generally, followed. Finally, the Court having agreed to the report, Deputy Harrison moved that they proceed by show of hands to reduce the five designs to two, and then elect one of the two for adoption. Upon that a long discussion ensued on the comparative merits of the five designs, having regard to the questions of headway and navigable waterway, cost, materials of construction, gradients of the proposed bridge and its approaches, breadth of road, the span and character of arches, foundations, and the time and mode of construction.

Each of the designs was then submitted alphabetically to a show of hands, until the number was reduced to two. The result was first to eliminate that of Mr Mylne, then that of Mr Fowler, and, thirdly, that of Mr Page, leaving those of Mr Brunlees and Mr Cubitt from which to choose. Eventually the Court, on a show of hands, adopted that of Mr Cubitt by a large majority. A division was called for, but foregone, the majority being so decisive. Then, on the motion of Mr John Young, jun., it was referred back to the Bridge-house Committee to take all the necessary steps, with the least possible delay, for erecting the proposed bridge after Mr Cubitt's design.

At one time, and for a considerable period, Mr Page's design was looked upon by the public as virtually adopted. We have not ourselves seen any of the designs, but from what has been communicated to us as to Mr Page's, and the precedent that Westminster Bridge affords, we feel sure, if adopted, the public would have possessed in his executed design, a commodious and durable structure, and London had added one additional trophy to the architectural grandeur of its monuments. What Mr Cubitt's design may be, we know not, and can but trust that it may be at least as good. The late Sir Wm. Cubitt, undoubtedly able as a constructive engineer, was not celebrated for his architectural taste. Mr Cubitt, his son, possesses here, an advantage that even Mr Page was denied; he is now engineer, both to the New Blackfriars Bridge, and to that intended to go close beside it, to carry the London, Chatham, and Dover Railway over the Thames. It is now in his power to combine these two into one noble and imposing structure, and in doing so greatly to improve the capabilities of both bridges for their respective uses. We presume his accepted design does not do this, which, if done, must involve again the production of a new design.—Ed.

RECENT PATENTS.

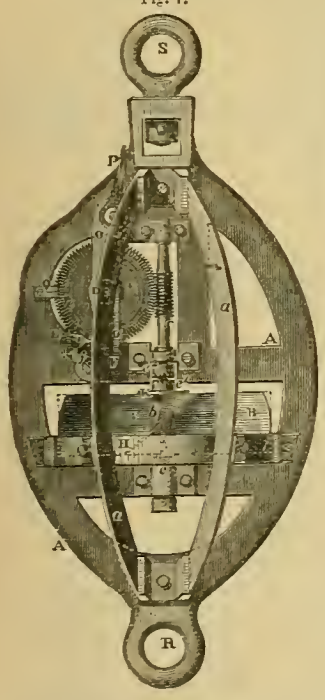
LOG AND DEEP-SEA SOUNDING INSTRUMENTS.

J. H. Johnson, *London and Glasgow*, (Wm. P. Trowbridge, and P. B. E. Dexsen, *New York, U.S.*)—*Patent dated April* 23, 1862.

This invention consists of improvements in that class of instruments for determining the depth in sounding, or as a "log," to determine the distance passed over in sailing, in which a helix, or screw, is made to revolve by the resistance of the water acting upon the threads or blades of the screw—the number of the revolutions being marked by wheel-work, and indices showing the angular motion of the blades in a given distance. Also, of an improved lead for bringing up specimens of the bottom in deep-sea soundings.

The object in view is to find the distance passed over, by a machine in water, under varying velocities, and different amounts of friction. As the instrument is sinking in the water, the forces which resist the rotation are, the friction of the water upon the surfaces of the blades, and its action upon their edges, also the friction of the wheel-work and pivots. The blades of the screw are made as light as is consistent with strength, in order to diminish the inertia of the screw, and secure a more uniform velocity of rotation, under varying velocities of descent.

Fig. 1.



In the annexed engravings, fig. 1 is a side elevation of the log, or sounding instrument, as constructed in accordance with this invention. Figs. 2 and 3 are side and edge views, respectively of the wheels and index, drawn to a very large scale, showing the manner of its action and attachment.

The frame consists of the plate, A, in which openings are made to receive the helical blades or screw, B, as well as the shafts, C, D, and wheels, E, F, G. These parts are surrounded on each side by the frame or fenders, *a*, formed in such a manner as to offer the least resistance to motion, and have sufficient strength to protect the blade and wheel-work from injury. The blades, B, are carefully formed to the threads of a screw—the distance between the threads, or pitch, being about one and a half feet. The blades are surrounded and protected by the guard ring, H, attached to the frames, A, *a*, and made as long as the space between the frames, A, *a*, will permit, and are fastened at the centre to a hollow axis or barrel, *b*, of small diameter. The pivots upon which the screw, B, turns when in its place, are shown at *c*, c^1, fig. 1. The lower one, *c*, projects about one-fourth of an inch into the hollow axis, *b*, which is bushed with suitable metal, to form a bearing for it. The upper pivot enters the upper end of the hollow axis, *b*, at c^1, in a similar manner. This upper pivot at c^1, is formed by the prolongation of the shaft, C, which has a bearing in the bush, I, and another bearing a few inches above it, at J. The hollow axis, *b*, and attached screw blades, B, are allowed a "play," or rise and fall, of about one-tenth of an inch upon the pivot, *c*. The object of this is to allow the blades to be held back when the apparatus is descending, by the resistance of the water against the blades. This upward pressure is increased by a small circular flange, K, attached to the blades, and surrounding the hollow axis. The upper end of the hollow axis is formed into a series of teeth, having one side vertical, as at c^1; and when these are forced upward by the pressure of the water, they engage with the ratchet, c^2, and remain so attached during the descent of the instrument, driving the endless screw, C, cut or formed on the first motion shaft. This screw revolves by the action of the helical blades and ratchet, and gives motion to the wheel, E, and screw spindle, D, which actuates the differential index wheels, F, G.

Fig. 2.

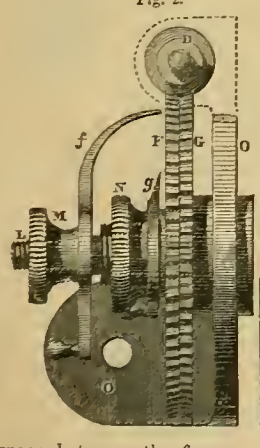
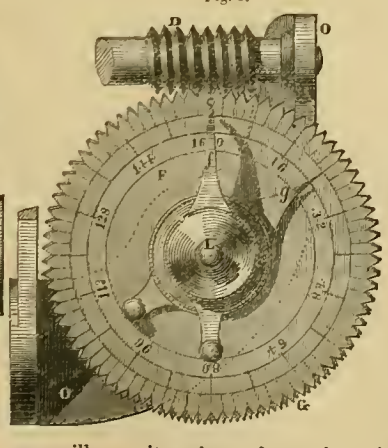


Fig. 3.



When the apparatus strikes the bottom, or is drawn up, the screw blades fall, or are held back, so that the two ratchets, c^1, c^2, are disengaged, and the blades revolve in the opposite direction, without communicating motion to the wheel-work. The reverse revolution of the blades diminishes the resistance when the instrument is drawn up, as compared with the old mode of blocking or holding the blades, to prevent them from turning round.

The instrument is used for determining the depth in sounding, or, as a "log," to measure the distance passed over by a ship—the apparatus, in this case, being towed astern by a small line. The blades turn once in one-quarter fathom, or one-and-a-half feet, and the indicating apparatus shows the distance passed over, from one-quarter fathom to one hundred and sixty miles. The wheel, E, worked by the screw, C, has one hundred teeth, and is divided on the face into one hundred spaces; this wheel therefore marks or indicates a motion of one hundred and fifty feet, or twenty-five fathoms. The axis of this wheel, E, carries another endless screw, D, which drives the wheels, F, and G, which turn independently on the axis, L, and in contact with each other. The front wheel, F, has eighty teeth, and the back wheel, G, has eighty-one teeth; therefore, the number of full revolutions will be shown by the distance of the separation of two points that were coincident, or set, at the beginning of the motion. The face wheel, F, is divided into eighty radial spaces—one for each tooth—and the number of spaces to be read is shown by the separation of the indices, *f* and *g*, in relation to their respective wheels, F and G, to which they are held by suitable collars, and set-screws or binders, M, N. By loosening the nut, M, the index, *f*, may be turned by the hand, and set at the zero or starting-point. One entire revolution of the wheel, F. is equal to 80 times 150 feet, which is 2000 fathoms, or about two nautical miles, and one full revolution of the wheel, G, is 80 times as much, or 160 miles. The indicating wheel-work is all attached to the plate, O, and by means of the eccentric arm, P, the wheel, E, can be thrown out of gear with the screw, C, for the purpose of setting the zero to the pointer, Q, which is affixed to the frame, A. A check-pin may be placed in the hole, *e*, which strikes the stop, Q, when the index mark and zero are coincident. This is used when sounding at night—the instrument being readily adjusted in the dark for the next cast. A thin band or ring of metal, H, is placed near the circumference of the blades, to prevent sea-weed, and other floating matter, from clogging the motion of the screw, B.

In sounding, the lead is fastened to a ring or eye, R, at the lower end of the frame, A, and the sounding line to a swivel ring or eye, S, on the upper end of the frame.

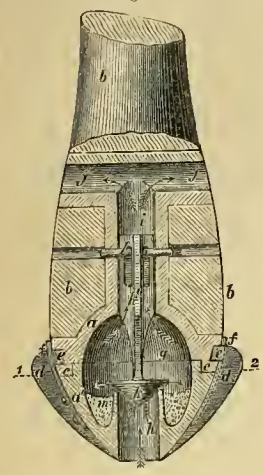
When used as a "log," the lead is taken off, and the line made fast to the ring, R, to which the lead was fastened, and the instrument is towed astern. In high velocities, a weight of four to five pounds may be fastened to the line, about three feet from the instrument, to sink it beneath the surface; and at low velocities, a float may be fastened astern of the apparatus to prevent it from sinking too low in the water. This being done, the instrument will record velocities as low as a quarter of a mile per hour. The pitch of the blades is determined by practical trials on known depths or distances.

By using the two sets of wheels, E and F, G, the instrument is adapted for sounding, and, without alteration, can be applied as a log and long distance measure.

The improvement in the specimen box for bringing up samples of the bottom is represented in fig. 4, which is a vertical section of the lead and box. It is made in two semi-circular parts, *a* and a^1, placed in a suitable cavity at the base of the lead, *b*, the lower part, a^1, being attached by two flanges and lugs, *c*, *d*, the latter entering the opposite sides of a groove, *e*, and held there by a bayonet clasp and spring, *f*. The central part of the two pieces, *a*, a^1, is hollow, forming a cavity, *g*, and below this there is an opening, *h*, about an inch in diameter. Above this hole there is a cylindrical aperture, *i*—its upper end com-

municating with an opening, *j*, made through the lead, *b*, for the discharge of water from the specimen box. A valve, *k*, rests on the upper end of the aperture, *h*, and has a ribbed or fluted stem, k^1, through which a slot of about an inch in length is made, to receive the transverse pin, *l*, which prevents the valve and stem from falling out when the lower part, a^1, of the box below the line, 1, 2, is taken off. While the lead is descending, the water enters the aperture, *h*, raises the valve, *k*, and, passing through the fluted stem, escapes at *i*, *j*. When it strikes the bottom, the sand or deposit passes upwards, and falls over on all sides into the annular cavity, *m*, at the lower part of the cavity, *g*. This annular space being below the top of the tube which forms the opening, *h*, the specimen taken up does not interfere with the closing of the valve, *k*, which returns to its seat as soon as the upward movement of the lead commences, and prevents the specimen from escaping. The part of the box, *a*, that is above the line, 1-2, may be formed in the lead, *b*, itself, or it may be made in a separate piece, and the lead cast around it.

Fig. 4.



The patentee claims the mode of connecting the revolving blades with the indicating mechanism by means of the ratchet, held in gear when descending by the resistance of the water, and put out of gear by concussion upon the bottom, or by the resistance of the water when ascending—thus allowing the blades to turn without moving the indicating apparatus.

Also, the combination of the rising and falling blades with the frame which supports the blades and wheel-work, in such a manner that the weight of the lead and strain of the line are sustained entirely by the frame, and not by the axis around which the blades revolve.

Also, the combination of a second endless screw with the axis of the first wheel driven by the blades, and driving the duplex, concentric, differential wheels, for the purpose of measuring long distances, as herein described.

Also, the improved manner of attaching the indices, by which the angular separation of two differential wheels may be noted or marked, together with the mode of ungearing the wheels and screw, and setting the wheels at the zero point, when commencing an observation.

Also, the specimen cup, having an annular cavity in the lower part of the chamber, to receive the materials composing the bottom, the inner wall of this cavity being the upper part of the tubular opening, and having a valve to prevent the escape of the materials while the lead is ascending.

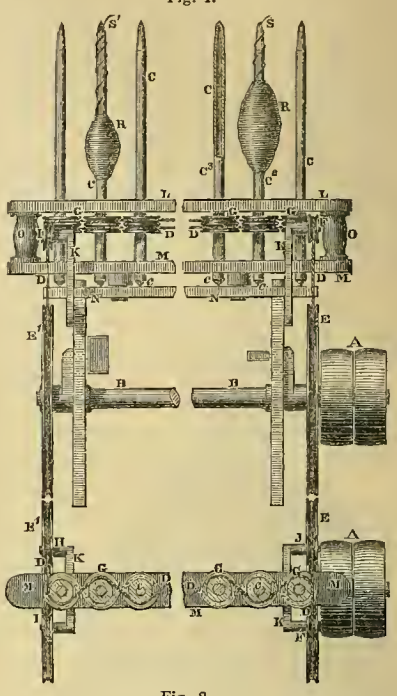
SPINNING.

J. H. Johnson, *London and Glasgow*, (James Eaton, *Boston, U.S. of America.*)—*Patent dated April* 1, 1862.

This invention relates more particularly to what are known as "mule" spinning machines, and consists, firstly, of an improved mode of driving the spindles, for which purpose a double grooved wharve or pulley is fixed or formed upon the lower portion of each spindle, and one strand of an endless band is made to pass alternately upon opposite sides of the upper series of grooves, whilst the opposite strand of the same band is similarly passed round the opposite sides of the lower set of grooves of the series, both sides or strands of the endless band being thus made to operate equally upon the opposite side of each spindle. The band, before entering, and after leaving the series of wharves or pulleys, is guided by stationary guide pulleys from, and on to, a larger grooved driving pulley, situate at each end of the machine, motion being transmitted to the band at each end simultaneously. *Secondly*, this invention consists of a peculiar construction of spindle, which it is proposed to make much shorter than the ordinary spindles, and of a hollow or tubular section, in lieu of solid, excepting at the tip and base. This spindle is supported upon a lower rail, and is steadied by being passed through two guide rails situate above the supporting rail, and parallel thereto. *Thirdly*, this invention consists of a peculiar form of the tip of the spindle, which it is proposed to make either conical or slightly rounded, and to form a helical slot or groove therein, into which the yarn enters, and passes thence into a small central aperture made vertically in the tip of the spindle, from which central point the yarn receives its twist, in place of passing or slipping over the end of the spindle at each revolution as heretofore. And *fourthly*, this invention consists in lubricating the spindles, by the application to the parts requiring lubrication of a piece of felt, or other absorbent material, saturated in oil or other good lubricant, such piece of saturated material being enclosed in a suitable lead or receptacle, provided with a hinged cover, which, when closed, will press the material gently against the part to be lubricated.

Fig. 1 of the subjoined engravings is a side elevation of part of a spinning frame, showing a few of the spindles as arranged and constructed according to this invention, as well as the mode of driving them; and fig. 2 is a sectional plan of the same, corresponding to fig. 1.

Fig. 1.



Figs. 3 and 4 are a sectional edge view, and plan corresponding, of the lower part of one spindle, showing its bearing and mode of lubricating the same.

Fig. 5 is an elevation of the point of the improved hollow spindle, showing the shape and form of the slit and concentric hole for the thread while spinning drawn to a very large scale.

The main features of these improvements consist in the system of banding or driving the spindles, and in the centre draft, or mode of making the tip or point of the spindle; also in the use of a hollow spindle, and in the mode of lubricating such spindles.

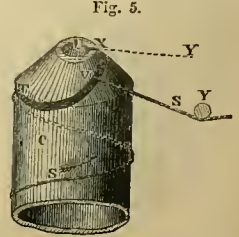
Fig. 2.

First, then, to describe the mode of driving the spindles which is more particularly represented at figs. 1, 2, and 3. The machine is driven by a belt from any prime mover passing over the fast and loose pulleys, A, on the first motion shaft, B, such motion being applied to the spindles, C, by an endless band or cord, D, passing round the two grooved pulleys, E, keyed on each end of the shaft, B, extending through the whole length of the frame. The driving band or cord, D, is made in one length or loop,—that is, it is a single cord, with the two ends spliced together, forming an endless band. From the first grooved pulley, E, at that end of the machine nearest the fast and loose pulleys, A, the band, D, passes upward and over the fixed anti-friction guide pulley, F, carried by the brackets, K, and thence round the back of the upper groove of the wharve or double grooved pulley, G, of the first spindle, C^1, thence it passes to the opposite or front side of the next wharve, G, of the second spindle, C^2, and so on through the whole series of spindles to the other end of the frame; here the band, D, leaves the last wharve and passes down over another anti friction guide pulley, H, and thence around the under side of the other grooved driving pulley, E^1, and up in front, where it passes over the third anti-friction fixed guide pulley, I, and enters round the back of the lower series of grooves in the wharves, G, and passing alternately in front and back of each wharve to the end of the frame as in the first mentioned course in relation to the upper grooves. When it reaches the first spindle, C^1, it passes down over the fourth guide pulley, J, and returns beneath the first grooved driving pulley, E, thus completing the circuit, and driving each alternate spindle in the same direction on each side of the wharve. The double grooved wharves may be formed in one piece with the spindle, or fixed to, so as to turn it by the frictional contact of the band or cord, D, applied at the same time upon the opposite side of the wharves, G. As the upper part of the band moves in one direction upon the upper grooves of the wharves, G, and the lower part in the opposite direction upon the lower grooves of the wharve, the motion imparted to each spindle is always in the same direction; but this direction

Fig. 3.

Fig. 4.

Fig. 5.



is alternate,—that is, every second spindle moves in one direction, and every intermediate spindle in the opposite direction. Viewed from above the upper and lower courses of the bands across each other between every pair of spindles, as shown in the plan, fig. 2, it will be perceived that the spindles are driven by the application of power simultaneously, at both ends of the frame or machine, from the two pulleys, E E^1, and that the band nearly passes round their whole periphery, as well as that of the wharves, G, of the spindles, C, thus ensuring very perfect contact for the driving action. Another advantage attending this mode of driving the spindles is, that the friction is very equally distributed upon the bearings, the spindle being held nearly in equilibrium by the equal pressure of the driving band applied to the opposite sides of the wharves. Instead of the long, heavy spindle commonly used in mule frames, an improved hollow spindle is used, formed about one-half the usual length, with only the point and lower part solid, as represented more particularly in figs. 3, 4, and 5; thus the weight to be driven is very much diminished. In order that the hollow spindles may be perfectly balanced and strong, it is preferred to make them of drawn steel tubes, thereby insuring perfect uniformity in the thickness of the metal. The spindles are supported in the manner represented more particularly in figs. 1, 2, 3, and 4, the upper bearing being in the horizontal rail, L, above the wharves, G, and its lower one in the rail, M, below them. In constructing the rails, L and M, they are planed flat and bolted together, when the holes are then bored through them for the bearings of the spindles, thus insuring perfect uniformity of the two rails when separated and supported in their proper parallel positions by the studs and brackets, O, P. A short distance below the rail, M, another parallel rail, N, is placed, having a hard polished surface, upon which the conical base or steps, c, of the spindles, C, revolve. The weight of the spindles being thus supported by the rail, L, a part of a cop of yarn is represented in fig. 1 at R, R^1, the yarn passing spirally around the spindle, and leading to the top of the same at S, S^1. The mode of receiving the yarn at the tip of the spindle and returning it at that point, or delivering it on to the cop, is one of the most important features of this invention.

In the ordinary mode of mule spinning the thread, while being spun and twisted, passes over the conical or pointed tip of the spindle as many times as the spindle revolves,—that is, at every revolution the thread leaves one side of the tip and passes around the periphery, and back to the side that it started from. This motion of the thread is not uniform, for, as the strain or draft on the thread is always in one direction, the velocity is greatest when it is moving towards the point where the opposite end of the thread is held, that is at the front rollers. This gives rise to an eccentric motion, the effect of which is seen in a succession of snaps or twitches upon the thread or yarn at every revolution of the spindle. This eccentric motion is communicated to the whole length of the yarn (about six feet when the carriage is at its farthest point), and all the threads are seen in rapid vibration, which prevents a uniformity of twist, and also causes a great deal of waste or flyings; the fibres are also left standing out from the thread, instead of being laid down to form an even and smooth surface. The new centre draft spindle obviates all these difficulties, the improvement relating in this particular to the shape of the tip or point of the spindle only; and the spindle itself may be of any required length, form, or construction. The tip or point of one modification of the improved spindle is shown in the enlarged view, fig. 5, having a conical form, but it might be of a slightly rounded, eliptic, or parabolic form, the main features being the same in either of these cases as in the form given in fig. 5. The thread, S, passes spirally around the spindle, and enters a spiral slot or cut at T, thence it passes to the small central hole, U, and upwards over the top of the spindle, from which it leads in the direction of the dotted line, X, Y, to the front rollers. The central aperture, U, is very small, not much larger than the diameter of the thread, and the helical cut or slot, T, V, begins at the top of the spindle, and extends from the walls or sides of this cavity to the outside of the spindle, passing obliquely downwards a short distance, usually not more than one-sixteenth of an inch. The slot is well polished and the edges rounded, so as to receive the thread easily when running up the spindle and deliver it freely when running down. In fig. 5, the line, X, Y, represents approximately the position of the thread when the carriage is at the end of its traverse outwards, the spindle revolving in the reverse direction of the arrow. As long as the spindle revolves in this direction the thread or yarn receives the twist, and has no tendency to leave the central aperture, U, or to enter the slot, V; but as soon as the motion of the spindle is reversed in the direction of the arrow to perform the operation termed "backing off," and the pressure bar, W, descends upon the thread, as represented in fig. 5, it instantly leaves the circular cavity, U, and runs down the slit, V, and spindle, C, indicated by the line V Y, in readiness to be wound upon the cop or bobbin. When the pressure bar, W, rises, and the spindle again begins to revolve in the reverse direction of the arrow, the thread instantly runs up the spindle and enters the slot, T, V, and takes its position at the centre, U, of the tip or point of the spindle, again in readiness for the next outward motion of the carriage.

It will be observed that, while the fibre is being drawn and twisted, the thread remains at the axis of motion of the spindle, and consequently no eccentric motion is imparted to it. The injurious vibration or throw of the thread being thus prevented, finer yarns can be spun with much less breakage from the same quality of fibre, than by the common mode of spinning.

Other important results are attained by the use of this improved spindle. The draft upon the sliver, as it is delivered from the front rollers, is now perfectly steady and uniform, for as the twist runs back in a straight line from the point of the spindle to the delivery of the sliver, the strain or tension upon it at the instant of delivery, or before the twist gets fairly hold of it, is not variable, and consequently very few ends are broken. Again, what is termed the "standing twist" can be dispensed with,—that is, instead of allowing the carriage to remain at rest when it is run out, as heretofore practised, and give additional twist to the yarn, it may be started back towards the rollers without stoppage, for as there is no vibration of the yarn, the whole of the twist is put in while the carriage is running out. To effect this, the velocity of the horizontal motion of the carriage is made to correspond with the number of revolutions of the spindles in order to give any required amount of twist. It will be perceived that by this process the twist is more uniformly distributed than it is when a large part of it is put into a thread five or six feet in length, for in the latter case the coarse parts of the sliver get but a small part of the twist, while the fine parts are twisted much harder than is required. To prevent these hard twisted parts from kinking whilst being run on to the cop, greater strain is required upon the yarn; this also is a cause of breakage that is avoided by this process as above described.

The vibration of the yarn being prevented by the improved point of the spindle, causes the wear of the spindles and bolsters to be very much diminished, and less noise produced; while the power required for driving the frames is much less compared with that heretofore required for driving spindles of the ordinary construction.

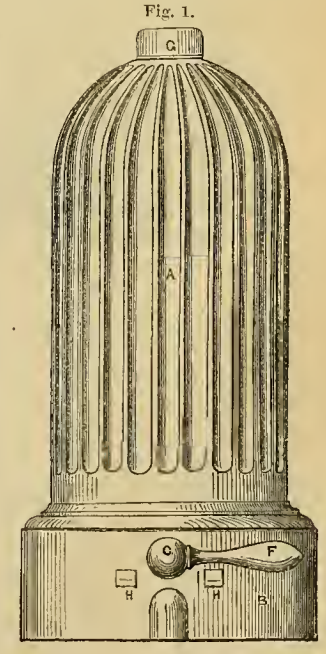
The improvements in lubricating the spindles is represented in figs. 3 and 4, and in the application to a door or cover, *a*, situated near the spindles opposite the bearings, a piece of felt, *d*, or other porous substance, saturated with oil, and enclosed in a suitable box or receptacle, *e*, so placed that as the door is shut (turning upon the hinge, *b*), the felt comes in contact with the spindle at its bearings, and supplies a small and uniform quantity of oil, all of which is utilized, while by the modes of oiling heretofore practised, more oil is wasted than is actually required to keep the bearings in good condition.

APPARATUS FOR PREVENTING WASTE OF WATER FROM SERVICE PIPES OR CISTERNS.

Charles Greaves, *Old Ford, Bow, Middlesex, Civil Engineer.—Patent dated September* 12, 1861.

This invention has for its object the prevention of the waste of water from service pipes and cisterns. One modification of the apparatus is shown in elevation and vertical section, at right angles to each other in figs 1 and 2 respectively of the subjoined engravings. It consists in the employment for that purpose of a closed air vessel, which is supplied with water from any ordinary service pipe, leading from the main, and is provided with a two-way cock, which is so constructed that, when turned in one direction, it will enable a supply of water to enter the air vessel, and partially fill the same, the air contained therein undergoing compression, and when turned in another direction it will shut off the supply entering the air vessel, and open the outlet from such vessel, the water then issuing therefrom with a certain pressure due to gravity and the pressure of the air in the air vessel. By this arrangement it is obvious that the water to be drawn off for use must come from the air vessel and not from the service pipe direct; hence the liability of the water being wasted by leaving the cock open is obviated as the contents of the air vessel only can be run off, In place of a single two-way cock, it is evident that two separate common cocks may be employed, but the preceding arrangement is much more

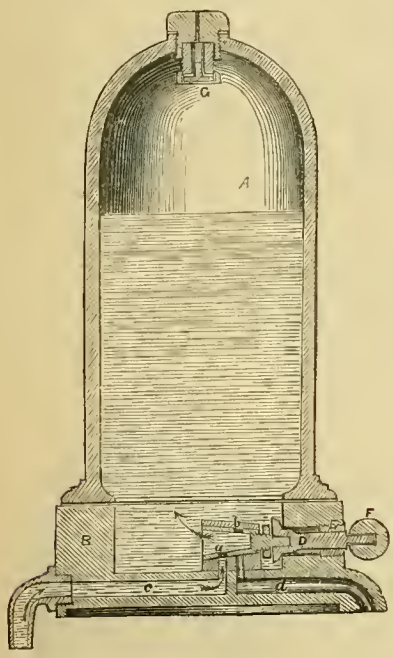
Fig. 1.



convenient. If it should be necessary to replace the air, which might, under some circumstances, be absorbed by the water or escape through small imperfections in the castings or fittings, an air inlet valve may be fitted air-tight to the upper part of the air vessel.

In these figures, A represents a perfectly air-tight vessel, bolted or otherwise secured at its lower end to a stand or base, B, (or, in some cases it may, having a simple plate or bottom cover bolted thereto,) to this stand or base is fitted a two-way cock, C, which may be either placed inside the stand or base, and near the bottom of the air vessel, with which it communicates, as shewn in the modification given in the two figures, or it may be placed outside thereof, when a plane flat sole is used and the vessel is placed on a pillar or shelf for common wells or water-closet, when the cock may be placed in any position convenient for use, as for example, outside the lower pillar, or underneath the seat of the closet, the air vessel in such cases being situate at the top of the pillar or closet, so as to increase the force of the jet below as that entering the basin. In whatever position the cock may be placed, however, it should be constructed essentially in the manner shown in fig. 2, namely, with two separate openings, *a* and *b*, which are made to communicate respectively with the two passages or thoroughfares, *c* and *d*. The inlet orifice, which admits water into the air vessel, is at *a*, and the outlet or supply orifice is at *b*, the one communicating, when open, with the passage, *c*, leading from the main or other source of original supply into the air vessel, and the other with the passage or pipe *d*, which conveys the water from the air vessel when required for use. These orifices *a* and *b*, are so situated and formed in the plug of the cock in relation to their corresponding passages or thoroughfares *c* and *d*, that one of them only can be open at one time.

Fig. 2.



The patentee does not confine himself to the particular form and construction of ground plug two-way cock which he has illustrated, as various other modifications may be employed, embracing the same principles, or even two distinct cocks of the ordinary construction may be applied thereto, operated upon by the same lever or other instrument; or in place of the two water way or two common plug cocks, two ordinary . high-pressure cocks may be used, operated upon by one handle or lever, the cocks having independent levers or closing and opening arrangements, and when in their normal position are always shut. Attached to the one opening handle, and projecting from the spindle connected with the same, are two studs, so arranged as to operate upon the lever, or closing and opening apparatus of each cock separately and at different times, so that only one cock can be open at one time, thus accomplishing the object as before described. These cocks so worked may be either inside or outside the air vessel, as preferred.

The arrangement shown will be found to be both simple and efficient. It consists of a hollow conical plug having apertures, *a*, *b*, made therein on opposite sides thereof, and in planes corresponding to the passages *c* and *d* respectively. When placed inside the air vessel, as in the figures shown, the plug is left open at one end, as seen in fig. 2, and is provided at the opposite end with a square head, over which is fitted the square socket of a spindle D, passing through a stuffing-box E, and having a key or handle E, applied to the outer end thereof, for the purpose of turning the same, as shewn in fig. 1. H H, are two stops for preventing the handle being turned more than a half revolution.

Fig. 2 represents the position of the cock when the apparatus is not in immediate use by the consumer; the inlet passage, *c*, leading from the main to the air vessel being full open, so as to enable the vessel to be fully charged with water until the pressure of the water is balanced by the counterpressure of the air, which is compressed within the upper part of the vessel, A.

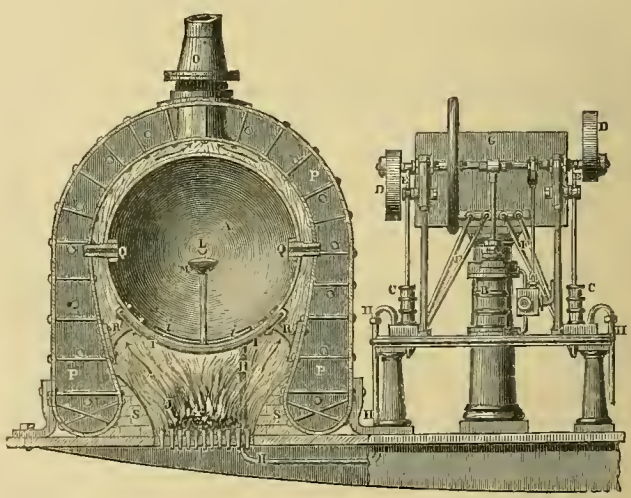
In case it should be necessary to compensate for the absorption of the air in the air vessel by the water, or its leakage therefrom, a small air inlet or "snifter" valve G, is applied, as shown in fig. 2, at the top or other convenient portion of the air vessel, which valve is made to open and admit a supply of air into the vessel should the pressure therein, when empty, fall below that of the atmosphere. This apparatus when adapted as a stand post or common well, is similar in construction to that inteuded for domestic use, differing only in the minutiae of configuration, such as the sizes of vessel and two-way cock; the air vessel being set on a tall pillar, the valve or cock may be either inside such column below the air vessel, as shown in fig. 2, or outside when more convenieut.

NEW STEAM GENERATING APPARATUS FOR MOTIVE POWER ENGINES.

Charles F. Hayes, *Enfield—Patent dated November* 5, 1861.

This invention principally refers to a new apparatus and mode of instantaneous generation and surcharging of steam, without the aid of the ordinary boiler, and is applicable for the same purposes as steam that is generated in the ordinary boiler for motive power engines, &c. This improved system of gaining power is valuable, as it not only does away with the necessity for the present enormous boilers filled with water, but it will prevent the fearful results of their explosions now so common. The effects of an explosion of this new generating apparatus would be attended with little or no danger, as there would be but a small volume of fluid contained in it, while

Fig. 1.

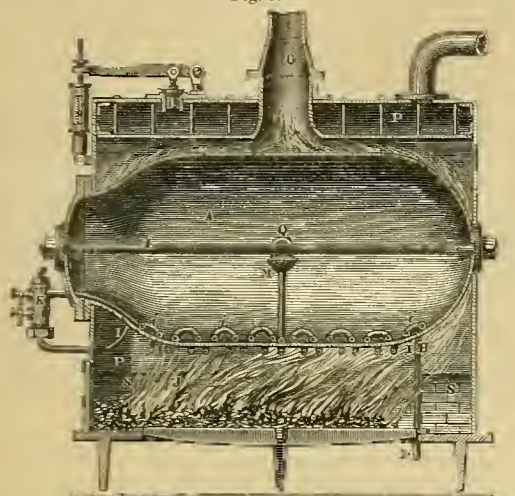


it has also the advantage of great saving in the consumption of fuel. Steam can be produced in this apparatus at the pressure of 60 lbs. on the square inch in less than one minute, and of a very humid description from the water or other suitable fluid injected through it, and applied to any of the steam engines now in use. It is suitable for high pressure or condensing engines, large or small, stationary, land, or marine; it would also be valuable for locomotives, as steam can be raised to a very high pressure in a short space of time. On account of its light weight, small consumption of fuel, and the little space it occupies, it might be advantageously used as a portable engine for agricultural and other purposes. It is particularly adapted for road locomotives, canal steamers, and fire engines.

Fig. 1 of the subjoined engravings, is a front elevation of the small pumping engine for injecting the water into the heating pipes, of two steam generators, placed one on each side of the engine, one only of which is shown in transverse section in this figure. Fig. 2 is a longitudinal vertical section of the new steam generator, and fig. 3 is a horizontal section of the same on two different planes, showing one half of the generating zigzag heating tubes both outside and inside of the generating vessel. In the arrangement and modification of the steam generating apparatus here shown, there is two steam vessels, A, with furnaces below them placed one on each side of a small direct acting "donkey engine," B, which works the four small force pumps, C, placed at each corner of the small rectangular sole plate of the engine shown supported on columns, and secured to one common sole plate, as seen in fig. 1. The piston rod of this engine is attached direct to a centre crank on the main shaft, working through a

spherical socket and sliding stuffing box in the top of the vertical cylinder. The crank shaft which is supported in bearings carried by a light malleable iron diagonal framing, has keyed on each end an eccen-

Fig. 2.



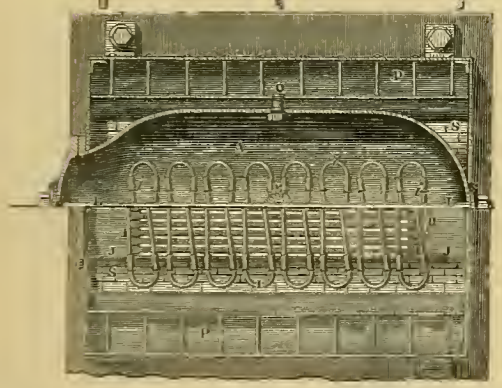


Fig. 3.

tric disc, D, having annular grooves formed in their sides. Two of the pumps, C, at each side of the donkey engine are for injecting the water into their adjacent generating vessel, A, and are worked by the bellcranks, E, centred on each side of the crank shaft. A roller carried in the vertical arm of these cranks works into the eccentric groove of the disc, D, while the horizontal arms are attached to the plunger of their respective pumps by a connecting rod It will be observed from the arrangement of the eccentrics and pumps, that the water which is drawn through the small suction pipes, E, from the supply cistern, G, as shown supported on a column behind the engine, is forced or injected into the generating vessels in small successive jets through the delivery pipes, H. For a 500 horse power engine, not more than a cubic inch of water is required to be thrown for every stroke of the pumps, so that the donkey engines are very small and require little power to drive them, which may be done by a small pipe from their own generator.

A delivery pipe, H, from each of the two adjacent force pumps, C, conducts the injected water into the back end of the coil of zigzag or serpentine pipes, I, outside of the inner vessel, A, immediately over the furnace, which, when it reaches the front end, enters the lower part of the induction valve box, K, arranged with an escape stop cock for blowing through and discharging either of the serpentine pipes, I, shown in fig. 2, in front of the generator. From the top of this valve box, the water now in the form of steam enters by a branch pipe, through the front cover of the inner vessel, A, to the series of similar serpentine pipes, K, lying on the bottom of the interior of the vessel. The fire being lighted in the furnace, J, upon the fire bars, (which may be hollow if required for taking up heat, the water being heated by passing through them before it is converted into steam in the serpentine pipe), the heat acts immediately on the feed or first length of generating serpentine piping, I, above it, running entirely through the furnace, J, and sufficiently far above the intense heat of the fire to prevent injury. This length of piping, I, is, by preference, laid in a serpentine form, as seen in the sectional plan, fig. 3, formed in short lengths, and connected by segmental bends or sockets with a right and left hand thread, but it can be placed otherwise both in form or arrangement when found more convenient, or advantageous. So soon as the water, which in very small quantities is forced into the heated part of the pipe, it is instantaneously converted into steam, and it travels with immense velocity through the whole length, surcharging it thoroughly in its course through the furnace, when it passes through the induction valve, K, entering the next length of piping, J, which is also laid in a serpentine figure on the bottom of the surcharging, or super-expanding chamber, A, after which it is distributed through a rose-head, M, finely perforated. This chamber, or cylinder, is so formed and fixed that the whole surface may, as much as possible, be subject to the direct action of the heat of the fire and of the heated products of combustion passing therefrom. The chamber is of a cylindrical shape, and being placed over the furnace with a space all round, it is quite surrounded by the flame which passes round it, the direction and current being indicated by the arrows, until it escapes up the funnel or chimney, O. The other sides of the furnace, or fire flues, are formed by the outer casing, or jacket, P, which is annular, and of the horse-shoe form, well stayed round the annular space. This supplementary vessel is not only of assistance for surcharging, from its inner surface being exposed to the fire, but acting as a large steam receiver and store-room for power, in conjunction with the vessel, A. The outside of the chamber, P, is covered with a non-conductor of heat, such as felt or wool, with an outer casing of wood, or sheet-iron hooped, for the purpose of stopping, as much as possible, the outside radiation. The communications between the cylindrical chamber, A, and the casing or surcharging chamber, P, is made by two very strong hollow tubular screw stays, Q, screwed into the plates, or shell of each chamber. This not only answers as a passage of communication, but is of great assistance in connecting and strengthening the two chambers. They are also further strengthened, and connected by four wrought-iron brackets, two at either end, as seen at R, in fig. 1. The part of the jacket which would be most exposed to the injurious action of the fire is protected with a lining of fire-bricks, as shown at S. The steam as it comes out of the rose, M, into the chamber, A, has become a most powerful and elastic force, having now increased immensely in volume, and unlike ordinary super-heated steam, it is quite cool and humid, so that not the slightest danger would attend an explosion. The common hemp and tallow is only necessary for packing the glands, &c., and a small drop of oil is quite sufficient for lubricating the cylinders. From the outer vessel, or chamber, P, any suitable connections, by steam pipes, can be made to the engines requiring the power. It has been preferred to build this apparatus very strong by staying, so that, if necessary, by pressing it very high, a large power can be gained in a small compass, but, in ordinary circumstances, it is not advisable that the pressure should go beyond the range of from 60 lbs. to 100 lbs. per square inch. A strong stay bolt, I, stretches through the inner surcharging chamber, A, and gives an additional strength and security for holding on the end cover. The mode of fixing the generators to the soleplate by four brackets is shown in figs. 1 and 3. Small hand pumps are used for the purpose of charging the generators with sufficient power to set the donkey at work, one or two strokes of which by the hand would be ample for starting the generator. A safety valve and appendages is also attached to the outer vessel, P.

MANUFACTURE OF SOAP.

HENRY ORTH, *Wissembourg, France.—Patent dated Nov. 5, 1861.*

THE patentee's improvements have reference to the manufacture or production of an improved soap, whereby considerable economy is effected and a quality of soap is obtained, having cleansing and detergent properties equal to those in ordinary use, whilst it is entirely free from any offensive odour. This improved soap consists of a mixture or combination of about one hundred parts in weight of finely levigated clay, such as pipe. clay, China clay, or other suitable aluminous or silicious earths, twenty parts of caustic alkali, such as caustic potass, caustic soda, or caustic ammonia, or the carbonates or bi-carbonates of soda, potash, or ammonia, corresponding to an equal amount of caustic alkali, and twenty parts of resinous matter, such as ordinary pine resin, or any other resin of a similar nature capable of being saponified. These proportions may be varied according to the quality of the soap it is desired to obtain, and the uses to which it is intended to be applied. In preparing this soap the resinous and alkaline, or caustic alkaline ingredients are mixed with about fifty parts by weight of water, and boiled together, ebullition being continued until the alkali and the resin are combined and saponified. The saponified mass is then mixed with the argillaceous or earthy matters, the whole being worked into a homogeneous paste, which is afterwards dried, and which is then ready for use. It is evident that this soap may be

prepared by mixing the saponified mass with the suitable aluminous or silicious compounds either at an elevated or at the ordinary temperature.

This soap is applicable to the washing of linen and other fabrics, and also to the cleaning and polishing of hard surfaces, its cheapness offering considerable advantages on the score of economy.

CINDER SIFTER.

Thomas Stanning, *Preston.—Patent dated December* 26, 1861.

This invention relates to the arrangement and construction of apparatus to be placed beneath ordinary domestic stoves or fire grates, for the purpose of preventing the loss of cinders and portions of coal which fall from such stoves or fire grates, and for collecting and separating the ashes therefrom, and preventing in a great measure the deposit of dust in the apartment.

Fig. 1 of the accompanying engravings represents a longitudinal vertical section of the apparatus; and fig. 2 is a plan of the same, as arranged to stand beneath the ordinary fire grate. A is a metal box or receptacle for the refuse ashes, and B is a riddle or sifter for receiving the cinders and pieces of fuel falling from the grate. This riddle or sifter rests upon and is supported by a frame, C, which is capable of receiving a to and fro sliding or reciprocating motion along the guiding rods, D, fixed in the ash box, A. E is a rod connected to the front end of the frame, C, and passing through the front of the ash box, where a knob or handle, F, is provided for facilitating the vibration or shaking of the sifter when required, for the purpose of sifting the contents thereof or separating the refuse ashes from the larger portions of fuel and cinders.

Fig. 1.

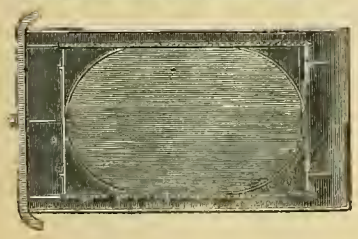


Fig. 2.

It it obvious that this combined apparatus is applicable to a variety of fire grates and stoves employed for heating purposes, whether in private or public buildings, on ships' board or in camp, and that it may be constructed in various ways without departing from the essential feature of the invention, namely, the combination of a vibratory sieve or screen with an ash box or receptacle beneath the same.

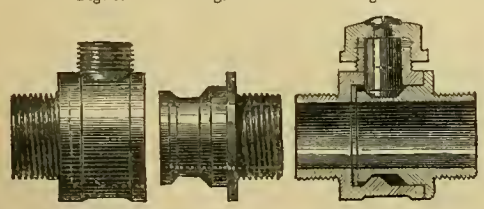
HOSE PIPE COUPLINGS.

J. H. Johnson, *London and Glasgow* (Thomas Braisted, *New York, U.S.*)—*Patent dated January* 1, 1862.

The improvements specified under these letters patent consist of certain peculiar arrangements of joints or couplings for hose pipes, whereby a perfectly tight coupling may be effected in a ready and expeditious manner.

Fig 1 of the engravings is a view of the outer or larger cylinder or thimble. Fig. 2 is a view of the inner or smaller cylinder or thimble: and fig. 3 represents a longitudinal section of the two connected. The hollow cylinder or thimble, has an internal flange or bevelled projection on one side, situate near the shoulder or packing seat—a sufficient space being left between it and the shoulder or packing seat to receive a packing ring or washer of leather, or other suitable material, and also the enlarged or bevelled end, of the cylinder or thimble, as shown in fig. 3; the flange or bevelled projection being so constructed that it may freely pass into the bevelled groove. Opposite to the flange, in the cylinder or thimble, is an opening or hole passing through the cylinder or thimble, and through the collar or boss, shown on the outer side of cylinder or thimble, on which it is cast or fastened, and is used either as a screw or nut for forcing the wedge or bevelled end pin into and against the bevelled edge of the bevelled groove in the cylinder or thimble. The cap or nut of the screw is attached to or forms a part of the wedge or bevelled end pin, and is arranged over the collar. It will be seen that the collar, by having the threads of a screw cut around its outer surface becomes the screw, and the cap the nut; or, if the thread be cut inside of the collar, the cap becomes the head of the screw, and the collar the nut. The inner or smaller cylinder or thimble, has a shoulder to receive the outer end of the cylinder or thimble; it is made to pass into the cylinder or thimble with sufficient ease to allow the enlarged end or projecting flange, beyond the bevelled groove, to pass easily over the flange or bevelled projection, the wedge or bevelled end pin being drawn up so as to leave the side opposite the flange or bevelled projection clear. The bevelled groove extends around the outer circumference of the cylinder or thimble, as before stated, and when passed into the cylinder or thimble, the end and projection beyond the bevelled groove, after passing the flange or bevelled projection, drops behind it, and the wedge or bevelled end pin is then forced down into the groove and against the bevelled edge, by turning the cap, which is formed so as to be used by the hand or by a wrench. The ends of the cylinders or thimbles opposite to those forming the connection are of the same circumference, and are provided for attaching the hose or pipe to them, which may be done by means of bands or screws, or in any other suitable manner.

Fig. 1. Fig. 2. Fig. 3.



WATER METERS.

William Dicks, *Floore, Northampton.—Patent dated October* 24, 1861.

This invention relates to the arrangement and construction of low pressure water meters, whereby greater economy, simplicity of construction, and increased accuracy of measurement are obtained.

Fig. 1 of the accompanying engravings represents a sectional elevation of the patentee's low pressure water meter, the front plate being removed to show the internal working parts. Figs. 2 and 3 are enlarged views of the mechanism for actuating the conducting spout, which is shown detached in vertical sections at fig. 4. The apparatus is divided into two main portions; the upper one, A, contains the measuring or syphon chambers, and the principal part of the mechanism,

Fig. 1.

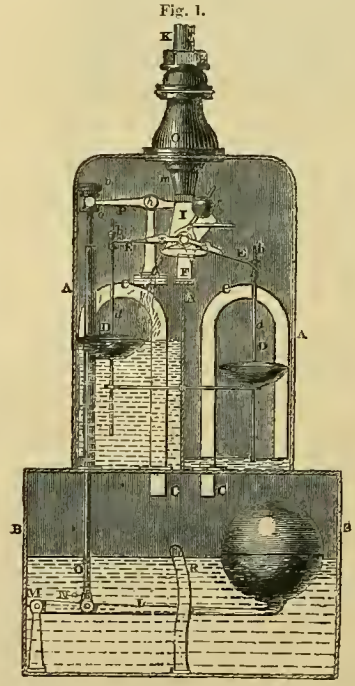


Fig. 2.

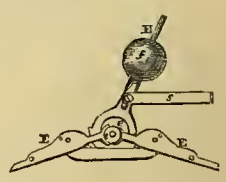


Fig. 3.

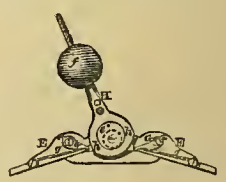


Fig. 4.

whilst the lowest part, B, forms the supply or service tank into which the measured fluid is discharged, and from which it is drawn off as required for use. This tank, B, may, however, be detached or separate from the measuring apparatus if preferred. C C^1 are the two syphons fitted respectively into the two measuring chambers; the longer leg of each syphon passes through the bottom of the measuring chamber and communicates at c with the supply tank, B, whilst the short leg extends

to within a short distance only of the bottom of the measuring chamber. In each measuring chamber, *a* a^1, there is a float, D, attached to rods, *d*, which are suspended from the free ends of two levers, E, working on one common centre, *e*, fig. 2, in the fixed bracket or support, F, on the top of the partition, A, separating the two measuring chambers. These floats are adjustable vertically so as to come into action at the proper time by means of the adjusting nuts, *b*. In each lever is jointed a spring catch or pawl, G, fig. 3, acted upon by a blade spring, *g*, and taking into a notch or projection, *h*, formed on each side of the lower portion or boss of the vertical tipping lever, H, which oscillates eccentrically to the working centre, *e*, of the levers, an eccentric boss, *e*, serving as the working centre round which the lever, H, oscillates. A weight, *f*, on the upper end of this lever facilitates its tipping action when brought beyond its central vertical position by the action of the pawl and lever, E, on the notch or projection, *h*. The oscillatory motion of this lever, H, is transmitted to the conducting spout, I, through the pin in the side of the lever, such pin working in a slot in the end of the spout, so that as the lever falls over to one side or the other, it will carry with it the conducting spout over to the same side. This spout oscillates on centres, *k*, in the fixed bracket or support, F, situate immediately over the central division line between the two chambers, A. It may contain one or more chambers or ducts, *l*, (two are represented in fig. 4,) and directly over each channel or duct is situate a supply nozzle, *m*, which directs a supply of water from the main or service pipe, K, into each channel. In all cases, the spout is duplex; that is to say, it is divided in the centre by a vertical diaphragm or partition, *n*, (fig. 4,) which serves as the back of the spout in whatever direction it may be inclined. The lower portion of the spout exteuds some distance below the centres, *k*, and is inclined outwards on the opposite sides of the spouts so as to direct the water which enters from the nozzle, *n*, into one or other of the chambers, A, according to the position of the spout. In the lower tank, B, there is a ball float lever, L, working on a fulcrum, M, and connected at N with a vertical rod, O, which rises up through a tube in the measuring chamber, A, and is connected at its upper end by adjusting nuts, *o*, to the end of a lever, P. This lever works on a centre, *h*, in a fixed bracket, and is connected at its opposite end to the lower end of a valve spindle, the valve of which is contained within the valve box, Q, fitted to the top plate of the meter. The object of this valve is to shut off the supply of water to the meter, as soon as the tank, B, is full, the consequent rising of the float lever in the tank effecting the closing of the stop valve through the intervention of the rod, O, and lever, P. As the water level in the tank, B, falls, the float lever will fall into it and will consequently open the stop valve again, and so allow of a further supply of water to the measuring chambers. In order that the falling of the float lever may take place suddenly, and so open the valve quickly, it is proposed to form a slight swelling on the inner surface of the guide bars, R, between which the lever, L, works, so as to grip it slightly when elevated, and still allow it to fall suddenly down, no longer supported by the water beneath. Previous to the water entering the meter, it passes through any suitable arrangement of pressure diminisher or regulator, so that the water will be delivered to the meter at a uniform pressure. Each to and fro movement of the spout is transmitted to the registering indicators at S, through the pall, *s*, jointed to the tipping lever, H, which pall takes into the teeth of a ratchet wheel, T, on the end of the arbour of the first of the series of counters. The action of this meter is as follows:—Supposing the meter to be entirely empty, and the spout, I, turned over into the position shown in fig. 1, the supply of water from the nozzles, *m*, will be directed entirely into the measuring chamber, *a*, and the rising of the level of the water in that chamber will elevate the float, D, and lever, E, sufficiently to bring the end of the pall or catch, G, into or over the notch or projection, *h*, in the boss of the tipping lever, H. So soon as the water rises to the top of the syphon, the latter immediately comes into action and will discharge the contents of the chamber, *a*, into the tank, B, below down to the level of the bottom of the short leg of the syphon. The rapid sinking of the water level leaves the float, D, unsupported, when its weight will draw down the lever, E, which will in its descent act upon the tipping lever, H, through the catch, G, and projection, *h*, and will turn it over to the opposite position, at the same time raising the spout, I, so as to direct the stream or supply of water into the opposite chamber, *a*, which is filled and emptied down to the level precisely in the same manner as I have described with reference to the chamber, *a*, the working parts being alike in both chambers. When the tank, B, is full, the float lever therein rises and shuts off the supply as before described, until by the drawing off of the water for use through the service pipe, U, the level has been lowered sufficiently to allow of the descent of the float lever, when the stop valve being again open, the supply is admitted as before. The tipping of the lever, H, from the position shown in fig. 1, to the opposite side, carries back the pall, *g*, one tooth over the ratchet wheel, T, and when the lever, H, returns to its former position, the pall will move forward with it, and turn the ratchet wheel and first dial spindle one tooth, such motion being effected so soon as the two chambers have discharged their contents into the tank, B. It is therefore obvious, that by regulating the meter, so that a certain definite fixed quantity of fluid will be discharged through each syphon, in turn, into the lower tank, B, the counter will indicate the aggregate quantity of water discharged into the tank, B.

LAW REPORTS.

PRICE *v.* CARVER: before Lord Chief Justice Cockburn, sitting at Westminster, and a special Jury.

This was the trial of an action for the infringement of a patent granted to E. J. Hughes on the 10th day of August, 1852, in respect of an invention imported from America. The title was originally "Improvements in Machinery, or Apparatus for Spinning and Weaving Cotton, Wool, and other fibrous substances, and also in Machinery or Apparatus for Stitching, either plain or ornamentally;" but the first part was afterwards struck out by a disclaimer, and the patent was confined to sewing machines. The plaintiff in the action is a trustee for the owners of the patent, and the defendant is a manufacturer of sewing machines, carrying on business at Manchester. The history of the patent is rather a singular one. The invention was brought from the United States of America by two persons, of the name of Waldo and Judkins, who had obtained possession, in a manner never clearly explained, of a machine constructed according to the invention of Messrs Grover & Baker, who were then commencing business as sewing machine manufacturers, at Boston, in America. The machine was brought to England, and hurriedly patented, along with other things, in the name of Hughes. Messrs Grover & Baker had previously sent out instructions to another patent agent to secure a patent in Great Britain, but the proceedings not having been pushed as rapidly as they might have been, Hughes' patent was obtained first, and the subsequent patent of the real inventors was rendered of very little value. The patent obtained by Hughes was assigned to Waldo, Judkins, and a third person, named Christie, who commenced the manufacture of machines under the patent. Various dealings afterwards took place with that patent; and ultimately Mr Baker, on behalf of his company, purchased the shares, as the only way of recovering their own invention. The patent was afterwards assigned to a Mr Jordan, as trustee for the company, and he, acting on their instructions, entered a disclaimer to part of the title and specification. The title now stands, "Improvements in Machinery or Apparatus for Stitching, either plain or ornamentally," and the claims in the specification were cut down to two, viz.:—the use of a rough-faced bar for feeding along the cloth to be sewn, such bar having *an up and down, combined with a to and fro motion*, or, as it is frequently styled, a four-motion feed; and secondly, the application of two needles in combination with each other, for stitching fabrics together—one of the needles working vertically, the other horizontally.

These contrivances being very useful, the plaintiff's machines would have had a very extensive sale in this country, had not infringement been at work in every quarter. It is believed that thousands of machines have been made and sold almost identical with the plaintiff's machine as a whole It therefore became necessary, either that the plaintiff should enforce the rights of the Grover-Baker Company, or that those rights should be altogether abandoned. The former course was adopted, and Mr Carver, who was doing a good business in the manufacture of sewing machines, was selected as a defendant, having been first warned that an action would be brought against him, unless he chose to take a license from the owners of the patent.

The case having come on for trial, Mr Bovill, Q.C., Mr Hindmarch, and Mr Macrory, (instructed by Mr J. Henry Johnson, of 47 Lincoln's Inn Fields,) appeared for the plaintiff, and Mr Webster and Mr Jones Aston appeared for the defendant.

The defendant, by his plea, and particulars of objections, put in issue numerous points, of which, however, it is only necessary to notice two, viz.:—the novelty of the invention, and the sufficiency of the specification. The defendant's machine was admitted to be identical in construction with the plaintiff's, so that there was no contest in court as to the fact of infringement.

With regard to the first point—the question of novelty—it was attempted to be shown, on the part of the defendant, that the feed of an old machine had been altered by some machinists at Oldham shortly before the date of Hughes' patent, and that such alteration consisted in applying to the old machine a four-feed motion similar to that claimed by the plaintiff's patent. That an alteration of this kind had been made on an old machine there was no doubt; the only question was as to the date. Two witnesses stated from memory that the alteration had been made in May; but a third witness declared that the alteration was made in October, the patent having been issued in August, and the firm's books of account showing the entry of the charge for making the alteration supported the testimony of this witness. It was evident that the other witnesses had confused previous alterations made on the same

T

machine, not affecting the novelty of the four feed motion, with the important alteration in question, and had predated the latter. This was the only circumstance which the defendant brought forward to attack the novelty of the patented machine; and the jury returned a verdict for the plaintiff on this part of the case.

With reference to the second question, it was contended, on the part of the defendant, that in order to produce work by the machine, it was necessary that some means should be adopted for taking up the slack of the thread of both the needles, or, in other words, for communicating tension to the threads; and that no such means had been pointed out in the original specification. It was further contended, that if the original specification were bad in this respect, the disclaimer could not amend it, since a patentee is only allowed to strike out, and cannot insert anything new. Therefore, even if he attempted to rectify this defect by the drawings attached to the amended specification, and had therein shown a piece of apparatus that would work, he might have improved the machine, but had invalidated his patent. In reply, it was said on the part of the plaintiff, that it was well known at the date of the patent that it was necessary tension should be communicated to the thread, and that if it had not been described in the specification, or shown in the drawings, a workman acquainted with the construction of sewing machines would immediately have adopted the contrivance of a spring to give the required tension. It was further contended, that it might be seen from one of the figures on the sheet of drawings, (see *x* in the engravings,) that a contrivance of this kind was contemplated, with reference to the horizontal needle, although the specification itself did not allude to it.

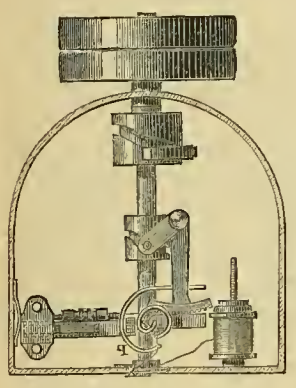


Fig. 3 of Hughes' Specification.

It was further contended, on the part of the defendant, that when the disclaimer abolished the forked lever, *q*, it rendered the performance of work by the machine still more difficult. If a new contrivance had not been adopted for giving tension to the thread of the horizontal needle, which new contrivance consisted in passing the thread through what might be called a second eye, and then round the back of the circular horizontal needle (see woodcut); that a patentee cannot legally introduce such an alteration into the specification by disclaimer, because it would be attempting to extend his exclusive rights. To this the plaintiff replied, that in making what had been styled a second eye in the circular needle (but which was not really an eye), and passing the thread through it, and round the back of the needle, nothing more had been done than to substitute one mechanical contrivance for another, and that an addition or alteration of this nature was quite allowable, and did not attempt to extend the patent rights.

Side Elevation of Circular Needle.

After the pleadings had been opened, the plaintiff's counsel called witnesses in support of his case.

Mr G. W. Reynolds, a manufacturer of stays, &c., at Birmingham, proved that he made use of a great number of sewing machines in his business, and that he found the Grover & Baker machine (of which he had 200) very useful; that the four-motion feed was an excellent contrivance, and that it was a novelty, as far as he knew, at the date of Hughes' patent; that all his machines of this class had a curvilinear horizontal needle, which in some cases had two eyes, in others only one; that the one-eyed curvilinear needle made as good work as the other, and that the thread only occasionally came out of the groove.

Mr C. R. Goodwin of Paris, the continental agent of the Grover & Baker Company, proved the very great demand for the machine of the Company on the Continent, and that they were made according to the specification as altered by disclaimer—the important parts being the circular needle, and the four-motion feed; that at the date of the patent this feed was a novelty; that the machine worked well without the forked lever, and that it does so with only one eye; that the forked lever was always made with a spring, with a view of keeping the thread taut, and that by making use of a stronger spring, it became unnecessary to use the forked lever, and that the machine would work as well without as with the forked lever.

Mr W. Newton Wilson, a dealer in sewing machines, established in London, proved that he had dealt largely in the Grover & Baker machines; that he was acquainted with Hughes' specification and drawings, and that the machine would work without the forked lever, and without any alteration on the circular needle; looking at fig. 3 of the drawings, he found indications of something to carry the thread, and a mechanic would, of course, understand a spring; that a spring was always used with the forked lever; that by the spring alone, without using a forked lever, the slack of the thread is drawn up; that there is enough in the specification and drawing to enable an ordinary workman to make the machine; that the witness was not aware of anything like the four-feed motion before Hughes' patent.

Mr Robert Mallet, F.R.S, Mr Fothergill, Consulting Engineer, and Mr James Nasmyth, C.E., were then called on the part of the plaintiff, and stated that, in their opinion, the original specification was sufficient to enable a workman of ordinary skill to produce an efficient sewing machine; that the alterations described in the disclaimer only related to mechanical equivalents for what was in the original specification, and did not alter the principle of the invention.

After the close of the plaintiff's case, witnesses were called by the defendant, with the view of showing, as before stated, that the four-feed motion had been brought into use before the date of the patent. He also called Edward Burns, a mechanician at Manchester, who pointed out that the original specification did not say anything about a spring for the purpose of taking up the slack of the thread, and gave it as his opinion that the specification did not afford sufficient information to enable a workman, to make a working machine; for it was necessary, in order that the apparatus should do work, that some means of communicating tension to the thread should be contrived; and he could not find that any such means had been described.

The Judge then summed up at length; and on concluding, directed the jury to say—

1st, Whether the four-motion feed had been brought into use previous to the date of Hughes' patent.

2d, Whether the invention, as originally patented, had been substantially altered by the disclaimer.

3d, Whether the information given in the original specification was such that an ordinary skilled workman could have made an efficient working machine from it.

The Jury retired to consider their verdict, which, after two hours' consideration, they found for the plaintiff on the question of novelty, and for the defendant as regards the sufficiency of the specification.

REGISTERED DESIGNS.

THE "MULTUM IN PARVO" METALLIC MUZZLE STOPPER FOR THE ENFIELD RIFLE.

ROBERT MARRISON, *of Great Orford Street, Norwich, Proprietor.*

THE purpose of utility to which the shape or configuration of this design has reference is the obtainment of a portable article, combining many of the various appliances requisite in rifle shooting, namely,—A cross piece or handle to fit the end of the ram rod when cleaning the barrel—A picker—An oil bottle—Colour boxes and brushes to paint the sights for sunny days, and an effective muzzle stopper, within which the whole of the previous articles are enclosed. Fig. 1, of the subjoined engravings, represents a half vertical section and elevation of the muzzle stopper, showing the appliances contained therein in elevation. Fig. 2 is a transverse section of the outer casing of the same, corresponding to fig. 1; and fig. 3 is a section of the cross piece or handle for the ram rod detached. A is a hollow casing fitting the bore of the gun, and forming a muzzle stopper, its outer surface having spiral ribs or projections, *a*, formed thereon, which fit the rifle grooves. B is a cap or cover screwed into the top of the muzzle stopper, so as to close the same, and this cap has a shank or prolongation, C, formed

Fig. 1.

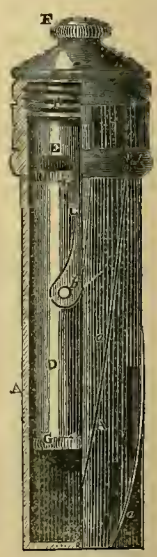


Fig. 3.

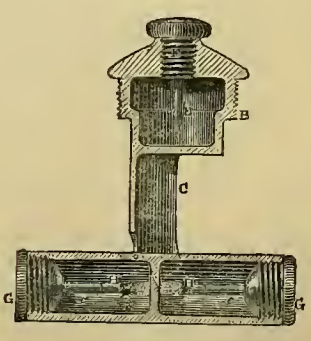


Fig. 2.

thereon, which is forked at its lower end, and is connected to a pin, *b*, with the cross piece, D, at the longitudinal centre thereof, the shank, C, being hollowed out or recessed on one side for the purpose of receiving the half of the piece, D, when turned up into its closed position for insertion into the outer casing as shown in fig. 1. An oil chamber or receptacle is formed at E, inside the cap, B, and this chamber or receptacle is closed by a small screw plug and picker, F, screwed therein. The cross piece, D, is hollow, and contains two chambers, *c*, for colouring matter, for painting the sights, its ends being closed by screw plugs, G, to each of which is fitted a small brush, H. When the cross or T piece shown detached in fig. 2, is to be fitted to the ram rod, to form a handle thereto, the picker, F, is removed, and the end of the rod is screwed into the opening which previously contained the picker.

The whole of this design for a "Multum in Parvo" metallic muzzle stopper for the Enfield rifle is new in so far as regards the shape or configuration.

REVIEWS OF NEW BOOKS.

FIRST STEPS IN PRACTICAL CHEMISTRY, FOR AGRICULTURAL STUDENTS, FARMERS, AND BLEACHERS. By John T. Hodges, M.D., F.C.S., Chemist to the Chemico-Agricultural Society of Ulster. 8vo. Fifth edition. Longmans.

This is an extremely nice little book, well balanced in its matter, and wisely limited in its scope to such aims and methods as, in analytical chemistry are possible, for any intelligent man not trained regularly as a chemist in laboratory manipulations. With a moderate amount of preliminary knowledge of the theoretic principles and facts of chemistry, this little work is an excellent text-book; without some such knowledge, as much, or more perhaps, may be done with it in the way of practical result, as is possible with any other work of the sort; but to a man absolutely ignorant of all chemistry, and taking up this or any other book, as a mere cookery book might be consulted, we think it, or any such work must prove useless, if not mischievous. The fault, in such case, is not in the book or the teacher, whose aim has been limited to a certain circle, but in the incapacity of the user.

The work is in twenty short and very lucid chapters, and the way in which *the practical* is ever held steadily in view cannot be better shown than by the following example, chiefly from Chapter XV., on the methods of determining the values of manures:—

The following are the prices per ton at which the chief ingredients of manures in a state of purity may be estimated. These prices, it must be recollected, will be influenced by the fluctuations in the rates to which the compounds upon which the calculation of their value is based are subject. They, however, may readily be corrected, and will enable farmers to obtain a close approximation to the money value of manures.

VALUE PER TON OF THE INGREDIENTS SHOWN BY ANALYSIS TO EXIST IN GUANO AND ARTIFICIAL MANURES.*

Water,	£0 0 0
Organic and ammoniacal nitrogenized matters,	Dependent upon the amount of ammonia which they are capable of yielding.
Organic matters destitute of nitrogen, and not capable of yielding ammonia by their decay,	£0 10 0
Ammonia,	56 0 0
Phosphate of lime,	7 0 0
Phosphate of lime rendered soluble,	25 0 0
Alkaline salts, when chiefly soda compounds,	1 0 0
Potash,	20 0 0
Common sulphate of lime (gypsum unburnt),	1 0 0

ILLUSTRATION OF THE METHOD OF VALUATION DESCRIBED.

A compound lately exposed for sale in the North of Ireland, and described as a Peruvian Guano of superior quality, was found, on examination, to consist of the following ingredients:—

Water,	9·84
Organic matter and ammoniacal salts,	22·16†
Alkaline sulphates and chlorides,	3·05
Phosphates of lime and magnesia,	16·08
Carbonate of lime,	9·23
Earthy matters,	39·64
	100·00

* To assimilate the prices given in the table with the present increased value of bones, guano, and all fertilizing materials, it will be necessary to add one-sixth to the value per ton of the manure.

† Capable of yielding 3·5 parts of Ammonia.

The valuation of the sample, according to the plan described, will show how far it falls below genuine Peruvian guano, worth from £11 to £12 per ton:—

	Value per ton.			Total.	
Moisture,	9·84	by	£0 0	£0	0
Organic Matters,	22·16	by	0 10	= 11	0
Alkaline sulphates and chlorides,	3·05		1 0	= 3	0
Phosphates of lime and magnesia,	16·08	by	7 0	= 112	0
Carbonate of lime,	9·23	by	0 0	0	0
Earthy matters (red loam),	39·64	by	0 0	0	0
Ammonia,	3·5	by	56 0	= 196	0
				100)322	0
				20	
				4·40	

Thus, taking the proportions of the several constituents, shown by analysis to be contained in the manure, to represent tons, we have, in 100 tons, ingredients which, to the farmer, are worth £322, so that the actual value of the manure is only £3 4s, or at present prices £3 14s 8d per ton.

The two following tables contain analyses of guano and of superphosphates, analysed by Dr Hodges, and are extracted from the monthly reports of the journal of the Chemico-Agricultural Society of Ulster:—

TABLE I.—*Composition of various Guanos.*

100 Parts Contained—	Peruvian.			Imported to Derry.	Imported to Ballymena.	South African.		Sligo.	Patagonian.	
Moisture	14·40	14·00	8 70	14·00	7 50	26.45	23 85	10·18	20·44	23 00
Organic Matters and Ammoniacal Salts	55·80	49·20	20 10	15·40	8 20	29·00	11·75	13·66	18 96	16 80
Phospha. of Lime	20 70	19 00	11·60	24·70	15·10	29·20	31·65	25·76	18 32	18 00
Sulphate of Lime	..	..	..	2·00	4·30	..	..	8·84	6·12	7 00
Carbona. of Lime	..	..	8·60	..	..	4·21	11 35	..	..	..
Alkaline Salts	6·92	16·26	5·00	6 40	1 15	6·14	2·20	8·26	8·84	6·36
Earthy Matters	2·18	1·54	46.00	37·50	63·28	5·00	19·20	33·30	27·32	28·84
	100 00	100 00	100·00	100·00	100·00	100 00	100·00	100·00	100·00	100·00
Ammonia	16 5	16·00	2·2	2·5	0 8	4·6	3½	4	0·5	0·4
Calculated value per ton	£12 18	£12 12	£2 8	£2 17	£1 19	£5 11	£5 2	£5	£1 19	

TABLE II.—*Composition of specimens of Superphosphates examined in the present season.*

Moisture	22·64	11·75	24·15	24·60	22·74	19·35	22·20	21·60	18 75
Organic Matters	12·23	7·28	11·13	7 93	8 00	14 34	14·20	16·60	9 90
Bi-phosphate of Lime	13·74	15 80	1·70	1·27	0·37	0·51	2·42	8 39	13 38
Bone phosphate made soluble	21·52	24·75	2 58	2 00	0 58	0·80	3·82	13·15	20·95
Insoluble Phosphate	1·48	3·85	20·62	18·56	17·02	16·40	17·06	8·55	13·05
Hydrated Gypsum	40 97	54·74	30·41	38·28	42·72	41 80	33 70	34·00	34·09
Carbonate of Lime	..	..	..	..	..	..	..	..	..
Alkaline Salts	5·16	1 98	5·04	4 08	1·19	1 90	2·42	6 64	4·53
Earthy Matters	3·78	4·60	6·95	5·28	7·16	5·70	8·00	4·22	6·30
	100·00	100·00	100·00	100 00	100·00	100·00	100·00	100·00	100·00
Capable of yielding Ammonia	1·46	0 86	0 30	0 15	0 40	0·56	0·80	1·1	Trace

Dr Hodges' work does not neglect the methods for the complete *physical* examination of soils, the agricultural importance of which is only beginning to attract the attention from chemists that it demands.—ED.

HANDBOOK FOR FIELD SERVICE. Edited by Colonel Lefroy, R.A., F.R.S. with the aid of several Contributors. Third edition, revised. Published by authority. Woolwich. 1 vol., 12mo. 1862.

FORMULÆ, RULES, AND EXAMPLES FOR CANDIDATES FOR MILITARY, NAVAL, AND CIVIL SERVICE EXAMINATIONS. By T. Baker, C.E. 1st Div.

PRACTICAL FORMULÆ FOR IRON WORK AND BRIDGES. By Charles Hutton Dowling, C.E. 2d Div. 1 vol, 8vo. Weale. 1862.

THESE are both Hand or Text Books. The first has been for a considerable time known in the scientific branches of the service as a pocket volume of "cut and dry" information at call. In successive editions it has become greatly improved, and this applies more largely to the present edition than to any former one;—nearly the entire 170 first pages have been re-written, and the information brought up to the day as regards the Armstrong guns and ammunition, &c., &c. The responsible editor,

Col. Lefroy, R.A., acknowledges handsomely in the preface the labour bestowed upon this by Captain A. Noble, R.A., an officer educated at Trinity College, Dublin, before he won his way to Woolwich academy, emerging from which he has since become a distinguished scientific officer. It would be absurd within our limits to attempt to give even an idea of the mass of information of a practical character condensed in this little volume, which reminds one of the packing of *materiel* in a field artillery store waggon. Time was, not so long since, when for us "pekins" to criticise, or even to praise, such a book as this, would have been superciliously deemed a rank presumption. The military "humble pie" of the Crimean war, and the part civilians have since taken in military improvement, have changed all that. May we then be allowed to say, that it seems to us some parts of this volume might still with advantage be excised, and their weight saved,—or if not, their place supplied with more useful matter,—the end and aim of the work always considered. For example, of what use to an officer in the field is all the matter, from p. 103 to 116, about the anatomy of the horse? He don't want to *learn* this in service; and if he has once learnt it he won't forget it for any popular use,—and for the military veterinary, it is superfluous and useless. Again, what is the use to *anybody* of the incomplete chemical scraps given at page 315, under the sonorous title of Chemical Examination of Laboratory Stores? A chemist does not want them,—to one who knows nothing of chemistry they are useless, and to one who knows a little they are only fitted to mislead.

Again, at p. 322, of what use to any one in service are the *general equations* for centre of gravity of *any* plane, and of *any* solid? They look very learned with such a swarm of triple integrals; but for any use they ever can be, we might as well have some of La Places' co-efficients, without anything to apply them to. Under the head *Work*, revision is is still needful. The unit of work is not 1 lb raised 1 foot, any where except in England and the United States. The foreign units should be given, and the relation between vis viva and work expressed. The table of squares and roots could be made much more useful and extensive in application, by a note or two explaining a few of the well-known expedients in use amongst calculators for getting out powers and roots beyond the reach of the table, particularly the relation between the squares and square roots of numbers, and those of others four times as great above as below. At p. 328, the table for converting thermometric degrees from one scale to the other seems absolutely useless, after the general formula has been given. Officers in service, and even military doctors in hospitals, having reports to give, are not *always* reading thermometers, nor always condemned to read one scale, and report in another.

Under the head of Strength of Columns, the formulæ given appear to be in entire ignorance of Eaton Hodgkinson's researches on their strength. The table of specific gravities, at p. 334, might be greatly improved for practical purposes, by giving the number of cubic feet in a ton, in place of the useless repetitive column of weight of a *cubic inch*—weight of a *cubic foot*. A good deal more, it seems to us, ought to have been said about the velocity of sound, which may often become so important a means of estimating distance to the soldier. Not a word is noticed of Professor G. Stokes' valuable results as to sound shadow, nor are the effects of wind on sound velocity ever noticed. We might somewhat extend these notices of what appear to us defects. Our remarks are not intended to depreciate, but simply to offer our mite in way of suggestion, for the improvement of what is already a meritorious little book, and in the praise of which we wish we could devote more space. There are some capital tables near the end for converting French and English measures, and to us new.

A really good text-book is the rarest of rare literary products. In the whole range of English literature, as regards civil engineering or mechanical knowledge, we do not know of one that can be called so. And we cannot reverse this sentence in favour of the second work that stands at the head of this review.

Why two distinct text-books, each on wholly different subjects, and with diverse arrangements, come to be advisedly thus bound up and called one, it is hard to see.

The first division, in alphabetical order, appears to be based upon a very old and much better book, "Carr's Synopsis," and like it deals with everything, from Annuities to Ships—*et multa prætærea,*—but there appears no attempt at judicious selection, either of subject or matter, anywhere. The book seems literally to fulfil its preface, and "to have been prepared with a view *to collect* into a brief space *numerous* formulæ, rules, and examples in *every* branch of the mathematics."

To the practical engineer, engaged at his profession, a large proportion of the matter would be troublesome chaff in his way, in looking for an odd grain of wheat; to the student or learner, no more than a very incomplete mathematical dictionary.

The second division does not to us appear to contain anything that has not appeared before in other and better forms, unless perhaps the facts about the Lambeth Bridge now in progress (surely not matter for a text-book), and the conversion tables for French and English weights and measures at the end. The only thing we can honestly say in praise of this book is that it is printed clearly, and on good paper, and got out in the excellent style that characterizes all Mr Weale's publications.—Ed.

The Fleet of the Future in 1862; or, England without a Fleet. By John Scott Russell, Esq., F.R.S. 8vo. Longmans.

Nearly eighteen months ago, Mr Russell published his first pamphlet, under nearly the above title, in which he expounded his views as to what the future fleet of England should be, seeing that even then, in his judgment, as in that of many others competent to form such an opinion, the existing fleet was, by the march of events, already, to all useful ends and purposes, annihilated, and that to replace it with any fleet but one of iron was to replace it but in name.

A year and a half ago, the author's views were received by a large class, the ignorant—with a sort of incredulous wonder—by a smaller but more influential and powerful one, with all the art and address by which suggestions that conflict with personal interests are known how to be disparaged and cushioned; and, as the readiest way to this, it was said that Mr Russell was but the mouthpiece of the great iron shipbuilders, who thought they had now an opportunity of gulling John Bull into a vast expenditure for their own sole benefits, and were determined not to lose the chance.

The dockyards — the Admiralty and the Bureaucracy that feeds upon both, declared that all that was time-honoured in England's naval supremacy was threatened—it was, in fact, a case of the craftsmen of Ephesus over again.

England's naval supremacy was, in very truth, then threatened, though not in the way the craftsmen would have had it. In the eighteen months since, twelve millions of public money have been expended on the "good old plan," and now Mr Russell comes forth again with a new pamphlet, or, rather as he calls it, a new edition. in which he shows with brevity, but with demonstrative plainness, that, if threatened before, England's naval supremacy now stands imperilled, and rather exists in the momentary forbearance of her possible enemies, as a supposition, than as a reality. In fifteen chapters of well-put argument, enforced in some places with the *vis comica* of ridicule, and nowhere shrinking from direct accusation of official incapability, he discusses anew what the future fleet of England must be, and how it is to be produced, and shows conclusively that the reasons why at this present we have practically no fleet, and have, for a year and a half, made no progress towards producing one, although squandering public money at a rate in the interval that would have amply sufficed to supply the want, are to be found in the incurable defectiveness of our naval administration. "The evil is this—that *where the knowledge is the power is not; and where the power is, the knowledge is not.*" After very fairly and temperately reviewing the general question of wood and iron for ships—in which, we may remark in passing, the whole *embroglio* of this matter lies in reality, the fact being that *every man* capable of forming a skilled and unbiassed opinion *knows* quite well that wooden ships of war are no longer possible; but all concerned with our naval administration and dockyards also know full well that with the exit of wooden walls, *their* prestige, power, patronage, and pudding depart likewise, and hence are moving heaven and earth to keep up these establishments; and if the floating walls may no longer be of wood, at least to have something wooden still preserved about them.

After putting all this with most unpalatable plainness, the author says—and recapitulating briefly what are the "*Warrior's*" capabilities—

"The question divides itself next into—What we want, and how to get it?

"I will take it that we want a Channel Fleet of twenty *Warriors*. The cost of this fleet is £10,000,000.

"I will take it next that we want a Mediterranean Fleet of twenty *Warriors*. The cost of this fleet is £10,000,000.

"I will take it next that we want a West Indian Fleet of twenty *Warriors*. The cost of this fleet is £10,000,000.

"Now I presume I have put here as large a fleet as the most ambitious admiral would venture to imagine. Yet the seven past years' income would have given us all that if we had honestly set about it; and the next seven years may give us all that if we wisely set about it, and that with a saving of cost.

"It is plain, therefore, that the revenue of the past seven years has provided ample means for the reconstruction of the navy; that it would have provided three fleets of twenty *Warriors* in each fleet; and that, instead of these sixty *Warriors*, we have at this moment two."

Here is what is wanted, and what it will cost. Mr Russell then proceeds to show what in reality would become of the £30,000,000, if it were all voted, in the existing state of things, by answering the question, How to spend the money—in fleets or in establishments?

"If you ask those men who have spent the last £30,000,000 without giving us our fleet, what it is best to do with the money, they will tell you by all means maintain the establishments: first spend the money on the dockyards, and afterwards, if you can, on the fleets.

"The proper reply to such advice is this: You have spent the money in your dockyards, but you have not given us our fleet. Is this to go on?

"The great establishments, the dockyards, are the great vehicles of expenditure. No machinery can be more effectually organised for the purpose of spending the money and not providing the fleet than the dockyards.

"I have found that the Bureaucracy of all countries delight above all things in large establishments, especially large war establishments in time of peace. Establishments have a wonderful power of permanence; they give employment to so many men, profit to so many buyers, sellers, and agents, give places to so many officers, and patronage on so grand a scale. Above all things, then, and before all things, large establishments.

"In time of war you enlarge your establishments to meet the demands of the war, and in time of peace you enlarge your establishments to prepare for the next war.

"In this respect the expenditure of the last seven years is faultless. It has fed the establishments; on it they have thriven; they are now greater than ever—greater and still growing.

"But look at the result. All those mountains have produced the glorious result of two ships of the line!

"But even that is too much. The establishments could not and did not produce the two ships of war composing the fleet of 1862. They were not built in the dockyards, but in the country; in short, the Government bought them, they did not build them.

"The way, then, to spend the money without getting the fleet, is to spend it on the establishments.

"The way to get the fleet is to buy it, and so save the expenditure on the establishments.

"There is no other way.

"The next point, then, is when and how to buy the fleet.

"But the same men who have spent your money on establishments without fleet, will tell you that it is impossible to buy a fleet of ships.

"Do not believe them. There is a show of truth, but it is deceptive merely.

"It is quite easy to buy your fleet. It is your only way to get it.

"The experience of the dockyards themselves shows the ease, the advantage, the profitableness, and the security with which you may buy your ships; the fact being that at this moment you do buy the most vital and important part of your ships of war, and that for many years past you have bought the most important item in the efficiency of any ship, in the market. You buy your armament, your naval artillery, you don't make them; you buy your marine machinery, your engines, and your boilers, you don't make them.

"You buy, then, the machinery and the boilers of your steam ships in the market. You buy them, not always in the cheapest market, not always of the best quality, but, on the whole, you buy more guns and more marine engines of good makers than of bad, and you pay for the good ones a fair price.

"You have therefore for the last seven years been paying for good marine engines, and getting them; you have been paying for good guns, and getting them: but you have been paying for a good fleet of ships, and you have not got them. The inference is not only logical merely, but is one based on sound practical considerations, and supported by long experience, that the way to get good ships is also to buy them. You bought the *Warrior* because you could not make it in the establishments; you bought the *Black Prince;* can any reason be alleged why in the future you should not buy your fleet of ships as well as your single ships?"

Such is Mr Russell's opinion of how the money is to be spent, and how the future fleet is to be got for it. It is a matter of no recondite inference what is to become of the dockyards—shorn of their ancient spendthrift glories they inevitably must be. It is a large and important inquiry, and too much entangled to discuss here what ought to be done with them; but what ought *not* to be done with them we ourselves see clearly enough. The attempt to convert them into great iron shipbuilding yards should never be made; it will only result in lavish expenditure for tools and plant upon a colossal scale, and hence the diversion of the public money from the direction in which it is imperatively required to be directly applied, namely, the fleet itself; and yet, in the end, the future ships will not be built with the means provided, they will in the long run, and mainly, we may safely predict, be *contracted* for.

In the only two remaining passages that we can afford space to quote, Mr Russell gives his own views of what are the chief requirements for the class of *Warrior* ships that he deems the best staple whereof to form the future fleet:—

"According to all the best authorities we have in naval warfare, there is no doubt that in future wars, by the aid of steam, the first element of victory is superior speed. Since the first edition of this work was published, experience has proved that the theoretical demand which it made on the resources of the country for speed was far from excesssive. My standard for the 'fleet of the future' was placed at 14 knots an hour. 14 knots an hour had then been done by none of our greatest men of war; it had not been done by the fleetest of them, even unencumbered by the enormous weight of iron armour; but I had formed my design of the original *Warrior* of 1858 for that speed. The Admiralty had also conformed their design of 1859 to that speed. Since the publication of the first edition, the *Warrior* has actually done, under armour and with all her fighting weights on board, from 14 to 15 knots an hour, in the open sea. The prediction is accomplished, and for the 'fleet of the future,' therefore, in England, no smaller speed can be accepted than 14 knots an hour. This, therefore, is the first element of the new fleet; this is what we mean by superior speed.

"Proceeding in like manner to the second element of victory, there can be no doubt that it consists in a superior power of artillery, or a more powerful battery of guns. Our vessels must carry a greater weight of guns than the enemy; these guns must be more effective, they must be better protected, higher out of the water; they must have a wider angle of training, must carry farther, straighter, and surer, as well as heavier, than our enemies. For some of these points we can trust to Armstrong; the rest must be provided by the ship, that the battery be carried nine feet out of the water, that the platform or deck from which it is fired be steady, even in a sea way, and that it be protected well when there from the shot and shell of the enemy, and that the fire be directed upon him in whatever direction from the ship he may lie, that is the business of the builder of the ship, and our improved *Warrior* has all these qualities.

"The third element of victory is protection; protection for the vitals of the ship, protection for the engines to which the speed of the ship is due, protection for the boilers, in which the penetration of a single ball would produce immediate explosion, protection to the crew from the shells of the enemy, from horizontal shell firing, protection to the guns from the shot of the enemy, which would dismount them or disable them. These are the things which want most protection, and that is the order in which protection is most needed. As to other things, protect more if you can; protect the entire ship with armour, if your ship can carry it; carry armour below the water line as well as on it, so long as you keep to the speed of victory, so long as you keep your armament undiminished in power, well out of water and sufficiently stable; carry armour everywhere, and protect everything, but do not sacrifice victory to safety merely. To buy protection, as has been proposed, at the cost of speed, or power, or victory, is to be a coward, to lose your power at the game of life. There can be no doubt, then, of the qualities to be secured in the first degree, in the second degree, and in the third degree; complete protection is in the third degree."

We have, as follows, his views of the "conversion" system applied to the existing wooden ships—that last spar to which the "wooden vested interests" are clinging:—

"In this *Merrimac* class, I fear, I must rank the large ships of our navy, which it is proposed to convert into shield ships. They are vessels, like the *Merrimac*, of over 3000 tons in tonnage, with monstrously heavy hulls, giving a weight altogether disproportioned to the small number of guns they can ultimately carry; half a dozen shields in a line of battle ship does seem a preposterous waste of money, material, steam-power, and men; as a mere floating battery such a ship could at least carry 30 guns, and if speed were not required, possibly 50. I cannot conceive a more wasteful incongruity than a sprinkling of guns in shields over such a mass of material, even our old floating batteries of 1854 seem respectable performances beside them."

In summing up his "conclusion of the whole matter—the wrong and the remedy"—he proceeds:—

"After many years of intimate acquaintance with the working of all the departments of the Admiralty and the dockyards, I have come to the conclusion that this is the hopeless evil of the existing constitution of things. No mere mechanism of office can remedy this fatal wrong. Put into power as First Lord a man who thoroughly knows every department of his business; and as you give him nearly unlimited power, his work will be done; but when you put there a man who *can* know nothing about it, you get what we see—a continuous muddle, and a total absence of systematic plan. It is true you give him plenty of advice and plenty of assistance, but unluckily it is for him to choose which adviser he will call in, and which advice he will follow; and unluckily the odds are, that he will be puzzled with contradictory opinions.

"It is this inability to decide among conflicting opinions which renders the present position of a First Lord so difficult. It has been well said, that no man can measure men much superior to himself, either in talent or information; how then can a First Lord, possessing neither extraordinary talent nor knowledge, settle whom he shall trust, and whose advice he shall adopt, in an infinite number of matters managed by an infinite number of people, of whose business he can understand next to nothing. The thing is absurd, and works neither better nor worse than it ought to do.

"This system, which begins at the top, goes regularly down to the bottom. The First Lord is generally a man who knows nothing about the navy. The first constructor of ships is frequently a man who knows nothing about the construction of ships. The first officer at the head of a dockyard knows nothing about ship-building; and the chief builder of a ship is permitted to know nothing of the designs and calculations on which the construction is founded, and he is not even permitted to entertain an opinion on the subject. This is the systematic principle of organisation of the Admiralty, its departments, and its establishments.

"Let the House of Commons resolve as follows:—

"First. That we will buy the fleet—not build it in the dockyards.

"Second. That the fleet shall be built at the rate of six *Warriors* a year, of the enlarged *Warrior* class.

"Third. That £3,000,000 a year shall be devoted exclusively to this purpose.

"Then in seven years you will have a fleet of forty-two *Warriors*, and in ten years a fleet of sixty *Warriors*, with an annual expenditure of much less than you have hitherto been expending in the dockyards without getting your fleet.

But you will ask, What then is to be done with the dockyards? To that I must answer, Which do you wish to have, FLEETS OR ESTABLISHMENTS?"

Mr Russell says in his preface (and he may be given credit for perfect truth in the statement), that "Nothing less than a conscientious belief that the subject of which he treats is at this moment of vital importance to the country, and that some such policy as he has chalked out may

save it from serious danger, has induced him to publish views which contradict so many received opinions, interfere with so many personal interests, and provoke the hostility of parties and persons who wield a vast power, influence, and patronage." Amongst these parties and classes, many will ascribe his writing simply to the hope of personal advantage to himself as a distinguished iron shipbuilder.

Even were this the fact, of what force is such an accusation, if so be that he has uttered truth and wisdom, and these alone. Of this, the whole naval department, from Whitehall outwards and downwards, may rest assured, that whether Russell had written his able and stinging pamphlet or not, an unseen and uncontrollable hand had already, in the mere march of events, written their "Mene, mene, tekel, upharsin."

Very many and deeply-important subordinate questions, still unsettled more or less, suggest themselves, as to the classes of ships of this future fleet. Although, in his pamphlet, apparently deeming it a settled thing that it should all consist of *Warriors*, this is probably but a result of brevity, and that Mr Russell does not confine his views wholly now to ships of that large class, which some naval men pronounce "unhandy," if not unfit for our channel service and home defences. The settling such points is not the drift of Mr Russell's production.—Ed.

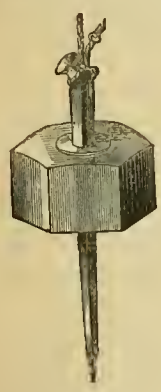
CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

NECESSITY THE MOTHER OF INVENTION.

Sir,—I forward herewith a communication for your magazine from a friend of mine, residing in New York, which I brought over from that country with me a short time ago. There is a small illustration with it, which will facilitate its introduction in your Journal, should you deem it worthy of insertion.—Yours respectfully,

Samuel Squire.



Harrow Road,
Paddington, London, July, 1862.

Happening in a machine shop one evening when they were making some alterations after the regular working hours, one of the workmen wishing to line down for the centre of a new shaft, found that his plumb bob was missing, and after a fruitless search for it was told to tie a string to a nut and make that do. I suggested that he should plug up the hole in the nut and drive a nail through the plug, and he would have a perfect one. He did so, and the annexed cut is an exact representation of it. Thinking it might again be useful in an emergency I send you the picture for the benefit of your readers.

Warren Rowell,
Rutgers Street, New York, U.S.

[A straight nail driven through, and exactly in centre and in line with the axis of the nut would no doubt make a decided improvement upon the common mode in which clumsy workmen adapt a nut as a plumb-bob. We cannot admit, however, that it would form a *perfect* bob in any case. The expedient, however, deserves a brief notice.—Ed].

MECHANIC'S LIBRARY.

Arithmetic, Bonnycastle's. By Rowbotham and Maynard, 3s 6d, cloth.
Astronomy, Observational, 8vo, 4s, cloth. Slugg.
Calico Printing and Dyeing, Dictionary of, Part I., 8vo, cloth. O'Neill.
Controversialist, The British, 1862, Vol. I., 12mo, 3s 6d, cloth.
Ferns, Natural History of, royal 8vo, 20s. Lowe.
Force, On Eccentric and Centric, 8vo, 10s, cloth. Pratt.
Gardening, Handbook of, foolscap 8vo, 1s, cloth. Glenny.
Language, Lectures on the Science of, 8vo, 12s, cloth. Max. Muller.
Products, Waste, and Undeveloped Substances, 6s, cloth. Simmonds.
Science, Popular, Review. Edited by Samuelson, Vol. I., 8vo, 12s, cloth.
Sketching, Lecture on, from Nature, folio, 21s, cloth. Stubbs.

ADMIRAL FITZROY'S REPORT ON THE METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT.

The system at present in use was organized in 1857; when it was arranged that simultaneous observations should be made daily at various localities in the British Islands, also in and around the Atlantic, and at stations on the European continental coasts. By combining these observations in synchronous charts and otherwise, it was discovered that though the weather and wind appeared to be quite irregular, yet that there was much uniformity and similarity of character in successive variations. It was further ascertained that by means of a comparatively small number of observations made daily at a few selected stations sufficiently far apart, and by the use of a self-registering barometer at a central station,—to which meteorological telegrams are sent from the outlying stations,—distinct intimation of marked changes of weather, and warning of dangerous storms, might be communicated to the centre, and from thence to all other points of any telegraphic combination.

On the 6th of February, 1861, the first warnings of portending storms were given. The value of this notice was particularly marked by the circumstance that a fleet of vessels became disabled or wrecked, on the 8th or 9th, which were lying off Shields, and whose captains disregarded the timely warning. The misfortune was, however, a singularly pertinent example of the truth of the homely proverb, that "it is an ill wind that blows no one good"; for since that event Admiral FitzRoy states that, "whether from having appreciated these storm signals or from other reasons, the *fact is* that very few wrecks occurred on our coasts during the notoriously tempestuous weather of February and March, 1861, and comparatively few since."

Admiral FitzRoy considers that the phenomena accompanying storms are now so readily explicable by the light thrown upon them by Dove's theory of polar and equatorial currents which has been translated and published by the Board of Trade, and they are so marked by barometers, that it is quite inexcusable to undervalue their warnings. The principal phenomena connected with storms may be thus summed up. Great and important changes of weather and wind are preceded as well as accompanied by notable alterations in the state of the atmosphere: approaching storms are usually shown by falls in the barometer exceeding one inch, and by differences of temperature exceeding about fifteen degrees. A tenth of an inch an hour is a fall indicating a storm or very heavy rain. The more rapidly such changes occur, the more risk there is of dangerous atmospheric commotion. These circumstances show the necessity of frequently observing the barometer, and the advantages of a self registering instrument. As all barometers often, if not usually show what may be expected a day, or even days, in advance rather than the weather of the present or next few hours, and as wind or its direction affects them much more than rain or snow, due allowance should always be made for days as well as for hours to come. Admiral FitzRoy recommends that the following table of average temperatures between 8 and 9 o'clock A.M. near London, should be used to assist in foretelling the direction and nature of coming wind and weather:—

January	37°	July	62°
February	39°	August	61°
March	41°	September	57°
April	46°	October	50°
May	53°	November	43°
June	59°	December	39°

The thermometer (shaded and in open air) when much higher between 8 and 9 o'clock A.M. than the average indicates southerly or westerly wind; but when considerably lower, the reverse or northerly currents of air *approaching*, if not present. It is important to observe that the above table of temperatures must be corrected for other places.

Careful observations have now proved that, although England is generally visited by one or more storms during the year, each of which is accompanied by terrible local disasters, yet all these tempests (be they ever so remarkable) are so much alike in character, and have been preceded by such similar warnings, as to warrant our reasoning inductively from their well ascertained facts, and thence deducing laws. Indeed, all investigations into the characteristics of storms show the same results. Gales from the south and west are followed by dangerous storms from the north and east. Those from the west and south come on gradually; whereas those from the north and east begin suddenly, and often with extraordinary force. The barometer with these north-eastern storms does not give direct warning upon this coast, because it ranges higher than when the wind is in the opposite quarter. But though the barometer

does not give much indication of a north-east storm, the thermometer does, and the known average temperature of the locality affords the means of knowing by comparison whether the wind will be northerly or southerly. Besides the familiar weather signs, Admiral FitzRoy considers that the following special peculiarities previous to great atmospheric commotions should be observed:—A great fall of rain or snow, much lightning, unusual cold, or excessive heat, invariably precedes high winds or strong gales.

Admiral FitzRoy is cautious in advancing any opinion respecting the connexion between electricity and storms. It is certain that although many eminent men do not think that magnetic storms, or even auroras, are directly connected with atmospheric currents, or have any special relation to storms, many facts on record seem to point to a different conclusion. We can only notice one; but this is most important. On the evening previous to the Royal Charter storm a brilliant meteor was seen, and during the previous week blood-red streamers of aurora were very prevalent.

We need hardly say that Admiral FitzRoy regards any faith in change of weather at the moon's quartering as utterly illusory, being based merely on deductions from coincidences, and not on any philosophical basis. It is, however, most remarkable how this unsound theory keeps its place among men even of high education.

Although the great working instruments of the meteorologist are the barometer and thermometer, which should be of the highest order of excellence, we are glad to hear that Admiral FitzRoy makes use of an instrument called a Storm Glass, which was much more common formerly than it is now. We have long been acquainted with this glass, and can speak confidently of its value in aiding with the barometer and thermometer in forecasting weather. Admiral FitzRoy has observed this instrument with great closeness, and these are his conclusions respecting its indications:—When a Storm Glass filled with the proper chemical mixture—(camphor, nitrate of potass and sal ammoniac, partly dissolved by alcohol with water and air in a hermetically sealed glass bottle)—is fixed undisturbed in free air, and not exposed to radiation, fire or sun, the mixture varies in character with the *direction* of the wind. As the atmospheric current veers toward, comes from, or is approaching only from the polar direction, the mixture grows like fir or fern leaves, hoar frost or crystallizations. As it tends to the opposite quarter, the lines or spikes,—all regular, hard and crisp features gradually vanish. Before and in a continued southerly wind the mixture sinks gradually downwards in the bottle till it becomes shapeless, like melted sugar. Before or during the continuance of a northerly wind the crystallizations are beautiful. The glass should be wiped gently occasionally, care being taken not to shake the contents. While any hard or crisp features are visible below, above, or at the top of the liquid (where they form for much north wind), there is *plus* electricity in the air; a mixture of polar current co-existing in that locality with the opposite or southerly. When nothing but soft, melting, sugary substance is seen, the atmospheric current is southerly, unmixed with and uninfluenced by the contrary wind.

In August, 1861, Admiral FitzRoy commenced publishing single "forecasts" of the weather. Twenty weather reports are received each morning and ten each afternoon, besides five from the Continent. Double "forecasts" (two days in advance) are now published, and are sent to six daily papers. As these "forecasts" have created considerable interest, Admiral FitzRoy explains the principles on which they are made. A barometrical height of 29·50, with about 60° of temperature, may be considered to indicate (if continued a certain time) fresh south-west wind and mild air, probably cloudy, perhaps rainy; about 30·50 inches, with 50° temperature, or less, would foretell and accompany north-easterly wind, dry weather, and usually a clear sky. Again, a high or rising barometer in the north-west, with low or falling temperature, while in the south and east the pressure is low or diminishing, indicates a north-west wind, either extending generally, or checked and deflected according to the diminution or increase of the temperature in the south-east.

Objection has been taken to such forecasts, because they cannot be always exactly correct for all places in one district. It is, however, considered that general comprehensive expressions, in aid of local observers, who can form independent judgments from the latter, and their own instruments respecting their immediate vicinity, may be very useful as well as interesting; while to a person unprovided with instruments, an idea of the kind of weather thought probable cannot be otherwise than acceptable.

But it is quite evident that enough is already known to enable an attentive observer, with good instruments, to acquire a useful foreknowledge of the weather during the coming day or two, or even three following days; and the utility of Admiral Fitzroy's weather warnings is amply illustrated by the fact, that notwithstanding the extremely stormy weather that prevailed in the North Sea during the first three months of 1862, the coasts of Durham and Northumberland have had a fortunate immunity from shipwreck, there having been no serious shipping disasters on that line of coast since November, 1861.—*Athenæum.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS OF IRELAND.

A general meeting of this institution was held May, 1862, B. Mullins, Esq., C.E., in the chair. Mr C. Hodgson read a communication "On the Manufacture of the Compressed Peat for Fuel, in Ireland." He spoke in the beginning of his paper of the extreme importance of utilising the peat bogs of Ireland, which extended over three million of acres. The great obstacle in the way of those who sought to utilise peat had always been the immense quantity of water contained in turf, and the difficulty—hitherto insuperable—of expelling it. Great mistakes had been made by those different companies and individuals who sought to make peat a good and useful fuel, and their failure might in many cases be attributed to their having under-estimated the quantity of water contained in the bogs. In some instances it had been represented as only one-fifth of what it really was. The quantity of the water contained in turf depended less upon the difference in the quality of the material than upon the process of manufacture adopted. In the general mass of bog, water made about 92 per cent. of the whole, leaving only 8 per cent. of solid matter. At the edges of the bog it was from 88 to 91 per cent.; on the partially dried surface from 75 to 82 per cent. In turf when first cut there was only 25 per cent. of solid matter; when placed in large piles there was about 50 per cent.; and in the stacks, the amount of solid matter was only 75 per cent. of the whole. No matter how carefully dried, there was never less than 11 or 12 per cent. It had unfortunately been ascertained that the more peat was required the greater became the cost of digging it. The Irish Peat Company had required 50 tons per day and had estimated the cost at 2s. 6d. per ton; after a while it rose to 5s. a ton; and ultimately not only did the supply become inadequate, but the average cost rose to 7s. per ton, at which price of course the manufacture became unprofitable. The paper described the defects of the turf in common use. It never was sufficiently dry to give its full effect in combustion; the carriage entailed a loss, as there was one ton of water to three tons of turf; it was bulky and cumbrous, moreover so light that in burning it could not bear a great blast; and the manufacture depended upon the weather, and was therefore precarious. The properties required to be generated in peat, in order that it might become a really useful fuel, were—first, dryness; second, density, so as to be easily carried and compact; and, third, hardness and tenacity, so as to bear a strong blast. Relying upon the excellence of peat as fuel when those disadvantages were overcome, many persons had engaged in its manufacture into fuel, but although it had been found quite impossible to overcome the disadvantages he had described, it had hitherto appeared to be a financial impossibility to do so with economy; and but for a new method which had been discovered by which three-fifths of the water was left behind in the bog, that paper would never have been written. His object was to describe this method, by which the greater part of the work of drying was done by nature, and the amount to be accomplished by artificial desiccation was minimised, and also to describe the certain improvements introduced into the machinery for compressing the peat. The paper went on to review various processes of compressing peat, which had already been tried. It referred to the process of straining, by which peat had been purified, but not sufficiently densified, and to the difficulty encountered in the attempt to dry it; for, when having been moulded, it was subjected to a very high temperature and a strong blast, it was found that these influences only affected the surface, and did not thoroughly permeate the mass. Mr Hodgson also alluded to the mode of compression by the hydraulic press, which, with all its advantages, was open to this cardinal objection, that it incorporated a quantity of water in the peat, rendering it impossible to dry it thoroughly, even although reduced to half its original weight and a third of its original volume. He also mentioned a plan by which the peat had first been reduced to powder and then compressed, but it was curious that the inventors of this excellent process had always laboured under the delusion that it should be compressed in a hot state. He then described the machine used and invented by him for compressing peat, dry and cold. It consisted of a horizontal reciprocating ram, working into a tube or cylinder with a smooth bore like an Armstrong cannon, and attached to an eccentric by which it was made to reciprocate. The ram entered the cylinder three inches and retreated four inches, and as it retreated turf mould was discharged into the top of the cylinder, which was open. After a few initial strokes of the ram the surface of the powdered peat became perfectly hard and smooth, and each successive charge was pressed against this, forming a separate block, and offering in its turn a hard surface against which the next charge was compressed. The blocks were discharged at the far end of the cylinder in a rapid and continuous stream, and owing to the vast pressure were superficially carbonised. The paper in conclusion described the processes of natural and artificial drying to which the peat was subjected. It was found that by taking off a thin layer at the surface of the bog, a substance was obtained three or four times as dry as the general mass. The top layer was cut in this way. Then a harrow was used until the surface was brought to a kind of velvet pile, one man being able to harrow an Irish acre in the ordinary way in about three hours. Then the surface was left to be exposed to the drying influence of the air for some time, and so before it was taken up the amount of water was reduced to sixty per cent., leaving it to artificial means to complete the drying. The artificial means adopted for this purpose was the waste steam of the engine of the compressing machine to which the peat was subjected between two iron plates. It was found that the steam could dry as much peat as the machine could compress—or, in other words, sufficient to keep itself supplied.

After some remarks from the President and other gentlemen,

Mr Anderson, of the firm of Courtney, Stephens and Co., said that as the machine had been made by the establishment with which he was connected, he could bear testimony to the simplicity of its construction, and having seen it

at work he could speak confidently about its excellencies. Five feet, or sixty cakes per minute were discharged out the cylinder in the form of a long sausage. Some of this peat had been tried at Messrs. Courtney and Stephens' works, but as the boiler was greatly overworked at the time, the trial was not fair or sufficient. The fuel gave out a great flame, which nevertheless did not injure the bars. The value of this fuel, compared with coal, was as 75 to 100; but as it could be produced at 9s., whereas coal cost 20s., per ton, the advantages of the manufacture would be easily apparent.

After some further discussion the meeting adjourned.

GEOLOGICAL SOCIETY OF IRELAND.

There was a general meeting of the society in the New Buildings, Trinity College, May, 1862. The Rev. Professor Haughton, President, in the chair.

Dr Sidney read the minutes of the last meeting.

A specimen of hæmatite from Cloghill, Kilbride, presented by Mr Scott Moore, was exhibited; also a nodule of iron pyrites from calp limestone, found forty feet below the surface in digging for the foundations of the new Molyneux Asylum, Upper Lesson Street.

Professor Jukes, M.A., F.R.S., read a paper "On the mode of formation of some of the river valleys of the South of Ireland." He gave a sketch of the physical structure of the South of Ireland, drawing attention to the fact of the lowness of the watersheds between the basins of the Liffey, Barrow, and Shannon, between Galway and Dublin, and to the curious fact that the rivers Barrow, Nore, Suir, and Shannon, cut by deep valleys through much higher ground on their way to the sea He then called attention to the valleys of the Blackwater, the Lee and the Bandon rivers in the South of Cork, and to the fact that each of them, after running for many miles from west to east in narrow defini'e valleys, suddenly deserted those valleys some miles before reaching the sea, and turned due south through deep ravines that cut across several intervening ridges, and entered the sea by a longer and more difficult course than the continuation of their own valleys would afford them. By reference to maps and sections Mr Jukes offered a hypothesis to explain these facts, which, if well founded, would show that all the later denudation of the country, by which all its present features have been moulded, was the result of atmospheric agency only. He arrived at the conclusion that the limestone plains and valleys were much higher than they now are, and that their present low level, when compared with the adjacent hills, is the result of the limestone rock having been dissolved by the rain and removed in a state of solution, while the other rocks have only suffered from mechanical attrition.

The President said that Mr Jukes had brought before them, in a highly interesting and original manner, a very curious subject, in which he himself had long felt much interested. The poet Spenser commented on the perverse course followed by the three sister rivers—the Nore, the Suir, and the Barrow. While the geological and physical structure of the regions through which they passed would seem to lead them in a direction from west to east, they suddenly, in a most extraordinary manner, changed their courses through ninety degrees and ran southwards. The President in expressing his own views on the subject, attributed the change in the river valleys partly to the existence of a series of joints or fissures in the rock formations prior to the period of the earlier river channels.

MONTHLY NOTES.

MARINE MEMORANDA.

Vessels and Tonnage.—A parliamentary return, just issued, shows that at the 12 principal ports of the United Kingdom 29,636 vessels, 9,159,530 tonnage, entered inwards; and 27,969 vessels, 8,711,572 tonnage, cleared outwards. The declared value of British and Irish produce and manufactures exported from the respective ports to foreign countries and British possessions in the same period was 109,415,749*l*.

Screw Steamer, "Claud Hamilton."—This vessel, belonging to the Intercolonial Royal Mail Steam Packet Co., has left the Victoria Dock for Australia; she was built by C. Mitchell & Co., of Newcastle-upon-Tyne; she is 210 feet long, 28 feet beam, and her cabins are fitted up in the most luxurious style for the accommodation of passengers. She is fitted with a pair of direct acting marine engines, manufactured by Robert Morrison & Co., Newcastle-upon-Tyne, upon their most improved plan; cylinders 40 inches diameter, stroke 2½ feet. On the trial trip in the Tyne she averaged 74 revolutions per minute, pressure of steam 18 lbs., vacuum 12½ lbs., indicated horse power 570, consumption of coals 2½ lbs. per indicated horse power. Messrs. John Dinnen and James Luke, her Majesty's inspectors were on board on behalf of the government, and Mr Robert Bowman, on behalf of the Intercolonial Royal Mail Steam Packet Co.; two of the directors of the company were also on board. The average speed of 4 runs each of 7 knots, was 10¼ knots, and although the ship was at sea for 12 hours it was not necessary to stop the engines during the whole of that time; there being no hot bearings, or any other defect in the machinery, and all on board expressed themselves highly satisfied with the result of the trial.

Thanks to the energetic movements of the National Life Boat Institution, the coast of Scotland, for which we have so long pleaded, is now in a fair way of becoming properly supplied with life boats and safety apparatus. The Institution has just sent one of its best double-banked lifeboats, accompanied by a transporting carriage, to Dundee, in the neighbourhood of which some dreadful shipwrecks with loss of life occasionally occur The boat is 32 feet long, 8 feet wide, and rows 10 oars. Her self-righting qualities were fully and satisfactorily tested recently in the Regent's Canal Dock, Limehouse, London. The water she shipped was self-ejected, through patent valves, in about thirty seconds. The following are some of the remarkable qualities of this boat:—1. Great lateral stability. 2. Speed against a heavy sea. 3. Facility for launching and taking the shore. 4. Immediate self-discharge of any water breaking into her. 5. The important advantage of self-righting, if upset. 6. Strength. 7. Stowage room for a number of passengers. The boat was built by the Messrs. Forrest, of Limehouse. The transporting carriage of the boat, which was built by Mr Robinson, of Camden Town, London, was also tried on the occasion, and was found to answer admirably. By an ingenious contrivance, the boat, with her crew on board, is launched off the carriage. With their oars in their hands, the crew are thus enabled to obtain headway before the breakers have time to beat the boat broadside on the beach. The hauling-up of the lifeboat on her carriage is accomplished with equal facility. A benevolent lady, Mrs Hartley of Bideford, Devon, has, through her own indefatigable exertions, collected upwards of £300 towards the cost of the lifeboat and transporting carriage. The Institution has named the lifeboat the Mary Hartley. A commodious and substantial house is being built from designs furnished by the London Honorary Architect of the Society, for the reception of the lifeboat, her stores, and carriage. In fact, there will be probably not a more complete lifeboat establishment on the whole coast than will soon be found at Dundee.

The Morpeth (Steamer).—This vessel, the property of H.R.N.S.N. Company, arrived yesterday, from Newcastle, having made the passage in 151 days, including her detention at the Cape of Good Hope. She left Newcastle on the 17th of November, under steam, which she carried to the Bay of Biscay; here she encountered very heavy adverse weather, when she was put under canvas; passed St. Vincent on the 23rd of December, and crossed the Equator on the 4th of January. On her passage from thence she sprung her foremast, and put into the Cape of Good Hope on the 16th of February to repair damages. These having been effected, she left again on the 1st of March, and made a fine run to Van Diemen's Land. She made her easting in the parallel of 46° S. and for eight consecutive days averaged 200 knots, under canvas, the wind varying from N. W. to S. W., proving her to be a very smart vessel. She passed the S. W. Cape on the 9th instant, and got up steam when off Cape Howe, having only been under steam for thirty six hours, from the Cape of Good Hope. The Morpeth was built to order for the company by Messrs. C. Mitchell & Co, of Newcastle. She is 222 feet over all, 25 feet 3 inches beam, 13 feet depth of hold, and when loaded with her coals and 150 tons cargo, draws 7 feet 6 inches. She is a paddle steamer, propelled by a pair of splendidly finished engines of 184 horse power; the cylinders are oscillating and are from the manufactory of Messrs. R. Morrison, of Newcastle. The main saloon is elegantly finished in maple, similar in arrangement to the City of Newcastle, but far loftier. Attached to this apartment is a commodious, enclosed cabin, fitted up with all the appliances for the toilet. The washstands are of marble, an unlimited supply of water being obtained from pipes leading to each. Forward of the companion is the ladies' saloon, replete with every convenience for the comfort of passengers. The Morpeth is a valuable addition to our already fine fleet of colonial steamers. She is a remarkably smart-looking ship, and no expense appears to have been spared in finishing her in a superior style. The windlass steering gear, and other deck appliances are of the most modern construction, and, taking into consideration the long voyage just terminated, has arrived in splendid order. She brought from the Cape of Good Hope 9 rams and ewes, consigned to Mr H. H. Buckham, all in fine condition; and we have to acknowledge the courtesy of Captain Raudall in supplying us with papers from that port to the first of March. No vessels connected with the colonies have been spoken on the voyage.—Sydney Morning Herald, April 19, 1862. [The Morpeth paddle steamer, has oscillating engines with feathering wheels 19 feet diameter, the cylinders are each 53 inches diameter with a 4 feet 6 inch stroke, boilers have brass tubes, pressure of steam on trial trip 22 lbs., vacuum 13 lbs., average revolutions per minute 36, mean draught of water 7 feet 7 inches, speed 14¼ knots per hour, indicated horse power 1000, consumption of coals 2¾ lbs. per indicated horse power.]

MISCELLANEOUS.

Oil Wells.—The number of oil wells now flourishing near Oil Creek (Pen.), the great centre of the trade in that State, is 75; the number of wells that formerly flowed and pumped is 62; the number of wells sunk and commenced is 358; total, 495. The amount of oil shipped is set down at 1,000,000 barrels; amount on hand to date, 92,458 barrels; present amount of daily flow, 5,717 barrels. The average value of the oil, at 1 dol. per barrel, is 1,092,000 dols; average cost of wells, at 1,000 dols. each, is 495,000 dols.; machinery, building, &c., from 500 dols. to 700 dols. each, 500,000 dols. The total number of refineries is 25. The oil sells at 58c per barrel at the wells.—*New York Sun.*

Single Shaft Mines.—In compliance with a circular from the Secretary of State, the inspectors of mines have made reports upon the subject of single shafts. It appears from these reports that the practice of having double shafts is extending more and more. Mr Dickinson states that, having conferred with seven of his colleagues, he is prepared to recommend that an Act be passed requiring two distinct shafts to be provided in every instance, except where a small tract is being worked by not more than ten persons. Mr Brough even recommends three openings for fiery collieries—one for the downcast and pumps, a second for winding only, and a third or upcast to be dedicated entirely to ventilation. Mr Blackwell, however, after reporting on the Hartley Colliery catastrophe, states his opinion that single shafts should not in future be permitted; but, with regard to mines now in operation, he feels obliged to represent that in the instance of deep mines, where large quantities of water have been stopped back by tubbing, and where the strata present unusual difficulties, the sinking of second shaft would involve an outlay so serious that

a legislative enactment enforcing such an expenditure would probably cause their stoppage, and throw out of employment a large number of the mining population.

South Kensington Museum Special Art Exhibition.—The Art Treasures Collection, which has been for some months past accumulating at the South Kensington Museum, is now open to the public. It consists entirely of objects contributed on loan, and includes a very large portion of the finest works of art of former periods extant in the kingdom, comprising specimens of goldsmiths' work, jewels, carvings in ivory, decorative furniture, bronzes, porcelain and pottery, glass, enamels, ancient illuminations, book-bindings, embroidered vestments, miniatures, &c. Following the example of the Queen, who has contributed many of the choicest art treasures of the Crown, almost all collectors of importance in Great Britain have lent their aid, and have their collections represented by the most valued specimens. The corporations and city companies—the universities in England, Scotland, and Ireland—and every important and public body, have contributed, so that foreigners and visitors from the provinces have the opportunity of comparing the treasures that have been laid up in this country during past centuries, with the products of modern art, represented from all parts of the world, in the International Exhibition. Thus it may be confidently asserted, that no such gathering has ever before been brought together in one building.

Uniformity of Weights and Measures.—A collection of the weights and measures of the various countries of the world, has been made by the International Association for obtaining a uniform Decimal System of Measures, Weights, and Coins, and is among the curiosities of the International Exhibition. Few persons are perhaps aware of the extraordinary diversities in weights and measures, and in their use, which exist in our own country. The price of corn, for instance, will be quoted in at least fifteen different ways in as many different localities; at so much per *cwt.*, per *barrel*, per *quarter*, per *bushel*, per *load*, per *bag*, per *weight*, per *boll*, per *coomb*, per *hobbet*, per *winch*, per *windle*, per *strike*, per *measure*, per *stone*. The word *bushel* is in some places used for a measure, in others for a weight, and this weight is by no means the same in all places. In different English towns the bushel means—168 lbs., 73½ lbs., 62 lbs., 80 lbs., 75 lbs., 72 lbs., 70 lbs., 65 lbs., 64 lbs., 63 lbs., 5 quarters, 144 quarts, 488 lbs.; and in Manchester, while a bushel of English wheat is 60 lbs., a bushel of American wheat is 70 lbs. The meaning of a *stone* is almost equally various. An acre of land expresses seven different quantities. These variations in measurement must be highly inconvenient, and prejudicial to trade; and the labours of the above-named Association are directed to bringing about a uniformity, which seems greatly called for. The metrical system employed in France is that which is advocated. This has been already established in Belgium, Holland, Sardinia, Lombardy, Greece, Spain, Portugal, and many other parts of the world. Great Britain and the American States still adhere to their old systems. A Committee of the House of Commons is now sitting on this subject, of which Mr Ewart is chairman, and those who have any pertinent matter to bring forward in advocacy of the uniformity proposed, should not lose the occasion of recording it in evidence. The chairman's address in London, is W. Ewart, Esq., M.P., 6 Cambridge Square.

Pollak's Lucifer Match Manufactories at Vienna.—Entering the spacious yard, immense piles of wood of various kinds, casks of chemicals of different sorts, and cases packed ready for transmission to almost every part of the world are to be seen. The arrangement of the raw material ready for use, the packing and loading of heavy goods for exportation, in fact, every detail in this extensive establishment, is carried through in a business-like manner. In the first workshop, a great number of men are planing wood, with a plane of very peculiar construction, into long thin slips; every stroke of this plane making four splints, each thirty-six inches long, which are gathered and bound in bundles of 500 each, and cut into two-inch splints, the exact size of the matches; 1,000 of these small splints of wood are put into presses by an ingeniously contrived machine. These small splints of wood pressed tightly together, are dipped into boiling *stearine*, and afterwards removed into other workshops where they are again dipped into a solution of phosphorus. This done, they are taken to the drying rooms, and within a few hours, through hot-air drying, are fit to receive the last coating, consisting of coloured varnish, when they are again dried and afterwards put into paper boxes made by an ingeniously constructed machine upon the premises. Not the least trace of that dreadful malady, which usually attacks the workmen employed in the manufacture of phosphorus, is here to be seen. This happy result in mainly owing to a judicious system of ventilation, carrying off the noxious vapours, and by strictly enforcing certain sanitary rules. Mr Pollak has manufactories at Prague and Budweis as well as Vienna, and branch establishments at other places. His business is very large, and his matches are found all over the world. He employs thousands of workmen, from the wood cutters who fell the pines in the forests of Bohemia, and the turners who make the wooden boxes in which certain kinds of matches are packed, to the persons engaged in the manufacture of the matches themselves. Two paper mills are constantly employed in the manufacture of the common sorts of paper, in which the matches are wrapped up for market; the better sorts of paper for labels and wrappers being supplied by other paper mills. The yearly consumption of phosphorus is about 20 tons. The enterprising individual who is the mainspring of these industrial employments, has lately found time to carry his energies into other fields, for he has erected a soap boiling and a sealing-wax manufactory.

Public Statues in London.—A return has been made "of the public statues or public monuments in London belonging to the nation, exclusive of those in palaces other than St Stephen's-hall, in the Palace of Westminster, or cathedrals, and now under the charge of the Chief Commissioner of Works, specifying the date of erection and names of the artists, if known, and from what funds purchased or erected." The list is as follows:—King James II., Whitehall-gardens, erected 1686, by G. Gibbons; the Right Hon. George Canning, New Palace-yard, by R. Westmacott, paid for by subscription; King Charles I., Charing-cross, by Le Sueur; King George III., Pall-mall East, 1836, by M. C. Wyatt, paid for by subscription; King George IV., Trafalgar-square, between 1840 and 1845, by Sir Francis Chantry, paid for by Parliamentary grant; Lord Nelson, Trafalgar-square, commenced 1840 (unfinished), by William Railton, E. H. Baily, J. E. Carew, M. L. Watson, W. F. Woodington, and J. Tearmouth, paid for by subscription and Parliamentary grant; the Duke of Wellington, Arch, Hyde Park-corner, 1846, M. C. Wyatt, paid for by subscription; Achilles, Hyde Park, 1822, by R. Westmacott, paid for by subscription; King George II., Golden-square; the Duke of Wellington, Tower-green, 1848, by T. Milnes, presented by the sculptor; King George III., Somerset house, by J. Bacon; Queen Anne, Queen-square, St Andrew, Holborn, and St George-the-Martyr; Queen Anne, Queen-square, Westminster; the Duke of Kent, Portland-place, by S. Gahagan, paid for by subscription; General Sir C. Napier, Trafalgar-square, 1858, by G. C. Adams, paid for by subscription; Dr Jenner, Kensington-gardens, 1858, by W. C. Marshall, paid for by subscription; Richard Cœur-de-Lion, Old Palace-yard, 1861, by Baron Marochetti, paid for by subscription and Parliamentary grant; Major General Havelock, Trafalgar-square, 1861, by W. Behnes, paid for by subscription. The statues of Hampden, Selden, Walpole, Falkland, Clarendon, Somers, Mansfield, Fox, Chatham, Pitt, Grattan, and Burke, in St Stephen's-hall, in the new Palace of Westminster, were erected between the years 1847 and 1858, and paid for by vote of Parliament. The sculptors were J. H. Foley, J. Bell, W. C. Marshall, E. H. Baily, P. M'Dowell, J. E. Carew, and W. Theed. This list by no means comprises all the statues in public places in London. There are many such which are not in charge of the Chief Commissioner of Works, as for example that of the late Sir Robert Peel in Cheapside. Amongst those enumerated that are in public places, the only one that even approaches to satisfy the eye of educated taste, is that of Charles I., by Le Seur. It seems as if we even retrograded in every attempt to produce a public statue in bronze. The very last, that of Havelock, being, beyond question, the most atrocious image set up in any thoroughfare, even of London.

Dealers in Old Metals.—An Act of Parliament, passed last session, with the view of checking the frauds to which owners of metal goods have hitherto been subjected, defines a "dealer in old metals to mean any person dealing in, buying, or selling old metal, scrap metal, broken metal, or partly manufactured metal goods, whether he deals in such articles only, or together with second-hand goods and marine stores. A complaint being made to a justice, that the complainant believes old metal to be kept or secreted in the shop or house of a dealer in old metals, the justice may empower a constable, by special warrant, to search for and seize all such metals; a summons is to be then issued to the metal dealer, and if he cannot satisfactorily account to the justice for his possession of the articles in question, he may be fined £5 for the first offence, and £20, or three months' imprisonment, for the second offence; or, as at present, he may be proceeded against by indictment at Quarter Sessions. When a dealer in old metals has been convicted under the section just mentioned, the justices may order him to be registered for three years in the police books; and on every subsequent conviction, the period of registration may be extended for three additional years. When any such registered dealer removes to any other town, he must give notice to the police of the town to which he has removed, in order that the unexpired period of registration may be completed, notwithstanding the removal. A metal dealer, who has subjected himself to registration, is placed under the direct supervision of the police, who may search his premises at any time, without special warrant. The dealer must keep a book, in which he must enter an account of all old metals in his possession, specifying the names, addresses, and occupations of the purchaser, the vendor, and the persons to whom the goods may have been afterwards disposed of. He must not purchase old metal before nine in the morning, or after six in the evening; or from any person under sixteen years of age; nor shall any person under that age be employed upon his premises. He must keep every article purchased by him, and "without changing the form in which it was when so purchased, or disposing of the same in any way, for a period of forty-eight hours after such article has been purchased or received." He must give immediate notice to the police, of the receipt or possession of any stolen property, of which a description may have been left with him. Finally, at any time when he may be required, he must produce to the police the books containing entries of all his transactions. In certain cases, an appeal is allowed to the Quarter Sessions; and it is provided that the Act shall extend to England only.

Induration of Stone.—The peculiarity of Mr Ransome's process for preserving stone consists in the production within the pores of the stone itself of silicate of lime—a substance which possesses the most enduring properties. He has hitherto accomplished the induration by first saturating the stone with a solution of the silicate of soda (soluble glass), and by afterwards applying a solution of chloride of calcium (muriate of lime). Here double decomposition takes place, the silica combining with the calcium to form a solid silicate of lime, and the chlorine at the same time combining with the soda, forming chloride of sodium or common salt, which is removed by subsequent washings or otherwise. It was in noticing the enormous cohesive properties exhibited by the silicate of lime thus produced that Mr Ransome was led to investigate the applicability of that material as an essential ingredient in the manufacture of stone itself, and the results of his experiments have been patented. The new process consists in mixing common sand, chalk, or other suitable mineral substances with a solution of silicate of soda into such a consistence that the mixture can be easily moulded into blocks or any other forms, rolled into sheets or slabs, or applied with a trowel as ordinary cement. Afterwards a solution of calcium is applied by means of a brush or by immersion, as may be most convenient. The effect is instantaneous, the material being immediately converted from a soft soluble substance into a hard insoluble compound, capable of resisting the influences of the most deleterious atmospheres, and possessing

the property of gradually increasing in hardness with the lapse of time. It is stated that the stone can in most cases he manufaetured upon the spot, from materials obtained in the locality; that it ean be moulded into any form or made in masses of any dimensions; that it is equally available for ornamental and decorative as for constructive purposes. It requires no artificial drying or hurning, while it is in no way liable to shrinkage or distortion of any kind. It exhibits all the characteristic features and appearance of the best freestone, and can he produced of any desired tone or colour. Dr Edward Frankland, who was appointed hy the Government to investigate the causes of decay of the new Houscs of Parliament, says, speaking of the tests to which Mr Ransome's new stone has been subjected :—"The chief ohject of these experiments was to expose the samples to influences similar to those to which the stones themselves would he suhjected, when used for outside work in our large cities; hut in order as far as possihle to arrive, within a moderate time, at results which under ordinary circumstances would only be obtained after the lapse of many years, it was necessary to intensify those influences by presenting the various chemical re agents to the stone more continuously, and in a more concentrated form than would he the case in the ordinary atmospheric degradation to whieh building stones are exposed. . . . . The experiments were made in the following manner :—The samples were cut as nearly as possihle of the same size and shape, and were well hrushed with a hard hrush. Each sample was then thoroughly dried at 212°, weighed, partially immersed in water until saturated, and again weighed; the porosity or absorptive power of the stone was thus determined. It was then suspended for forty-eight hours in a very large volume of each of the following acid solutions, the alteration in weight after each immersion being separately estimated. Solution No. 1, water eontaining 1 per cent. sulphuric acid; solution No. 2, water containing 2 per cent. sulphuric acid; solution No. 3, water containing 4 per cent. sulphuric acid. The sample was then boiled with water until all acid was removed, and again weighed. Finally, it was dried at 212°, brushed with a hard brush, and the total degradation or loss since the first brushing was ascertained." There was no loss with 2 per cent. or with 4 per cent. of dilute acid, and only the fractional portion of a single part, as shown in the total degradation from all causes. Dr Frankland thinks that "Mr Ransome has invented a material which, with the exception of the granites and primary rocks, is hetter capahle of giving permanency to external architectural decorations than any stone that has heen hitherto used."—*Society of Arts Journal.*

Natal.—This rising colony, says the *Times*, makes a very admirable display in the Exhibition, and the small space which has heen allotted to it is crowded with interesting objects. The natural products of the colony are very fully illustrated, and the sugar in particular, which within the last ten years has hecome one of the staple products of the colony, will, no doubt, he examined with much curiosity. Twelve years ago a sample manufactured from Natal canes was handed ahout the colony as a curiosity; hut within the last two years 2,000 tons, exceeding £50,000 in value, have been exported. The specimens shown here are pronounced to he of excellent quality, and there can he no douht the climate and the soil are admirably adapted for the production of this necessary article of food. The rapid development of this capahility has led to a rise in the price of land in the colony almost unprecedented. Of arrowroot, for which the colony has also a speciality, there are some fine specimens shown, as well as of coffee, wheat, harley, and maize. Within the last few years the Assam tea plant has heen introduced into the colony, and is said to thrive with great rapidity. Some samples of it are exhibited side hy side with a small quantity of the Bushman's tea. Another very important item of the eolonial exports appears here in the shape of Cayenne pepper, which is said to command excellent prices. Like a great many other places just now, Natal is trying her hand at producing cotton, and some specimens are shown of fair quality. The plant grows readily in the colony, hut the chief difficulty is in finding lahour. The Colonial Government is making great efforts to induce the Caffres to take to the growing of it, but it appears at present uncertain whether they will be able to overcome the deep-rooted aversion of the nohle savage to anything in the shape of work. The cotton shown here was hoth grown and ginned hy natives, and there is a sample of wool produced from a wild plant indigenous to the country. We may mention in passing that the finest specimens of cotton shown at the Exhibition are from our colonies. New South Wales sends some Sea Island cotton, which has heen pronounced hy such judges as Mr Bazley and Mr Ashworth to be the finest ever seen in this country, and the price they put on it was 4s per lh. From Queensland Mr Marsh exhibits a sample little inferior, which was priced by the same judges at 3s 6d per lh. The walls of the Natal court are ornamented with some magnificent skins of antelopes, leopards, and other animals shot in the neighhourhood of the colony, and among them is the skin nf a boa, 18 feet long. Elephants' tusks are a considerahle article of export, and one is shown here weighing 126 lh. A very interesting portion of the Exhihition is the collection illustrating the hahits and modes of life of the Caffre. His great luxury seems to he snuff, and here are every variety of snuff boxes and snuff-spoons, generally earried in his back hair, along with his nose scraper and other useful articles, and some of them show considerable skill in carving. A few of them smoke, and by sticking a reed with a howl made of soapstone at the end of it into a cowhorn, which they fill with water, they manage to extemporize a very rude kind of hookah. Their greatest ingenuity however, is shown in their musical instruments. The Caffre lyre is a hent how strung with twisted hair, which beaten with a stick will give out some four or five distiuct tones, while the Macahere piano, which is a series of stripes of wood, each hacked by a sounding chamber formed of the rind of some dried and hardened fruit, has one or two notes very nearly approaching to the music of a eracked hell. The extraordinary top-knots which are the most distinguishing feature of their simple costume are well illustrated hy a specimen which was torn off the head of a native in a scuffle at D'Urhan some little time ago. Two or three articles of red pottery ware, which belonged to the famous Moshes, are surprisiugly excellent in quality. There is a smoothness and finish about them which proves considerahle proficiency in the art. In timbers the colony appears to he rich, for there is an immense variety shown, some of them possessing great durahility, while others are useful only for ornamental purposes. Two of them rejoice in very singular names,—the "sneezewood," which is of extraordinarily tenacious fihre, and stands exposure to the weather admirahly, is so ealled from the pungent qualities of its saw-wood, and the "stinkwood," which is a furniture wood somewhat resemhling dark walnut, while green gives out a most disagreeahle odour. There is also a very handsome pink wood, which would he valuahle to the upholsterers.

Calculating Machines.—The principle upon which Mr Bahhage's Difference Engine is constructed may he thus explained :—If we consider the series of whole square numhers—1, 4, 9, 16, 25, 36, 49, 64, &c.—and suhtract each of them from the succeeding number, we obtain a new series—which may be named the Series of First Differences—consistiug of the numbers 3, 5, 7, 9, 11, &c. On suhtracting from each of these, the preceding one, we obtain the Second Differences, whieh are all eonstant and equal to 2. Now, to conceive how these operations may he reproduced hy a machine, let us suppose the latter to have three dials, A B C, on each of which are traced say a thousand divisions, hy way of example, over which a needle shall pass. The two dials C D shall have in addition a registering hammer, which is to give a number of strokes equal to that of the divisions indicated by the needle. For each stroke of the registering hammer of the dial C, the needle B shall advance one division; similarly, the needle A shall advance one division for every stroke of the registering hammer of the dial B. The theorem, in short, upon which the construction of the machine is hased, is a particular case of the general theorem that if in any polynomial, or quantity consisting of many terms, the highest power of whose variable is m, this same variable be increased hy equal degrecs, the corresponding values of the polynomial then calculated, and the first, second, third, &c., differences of these be taken (as for the preceding series of squares), the mth differences will he equal to each other. So that, in order to reproduee the series of values of the polynomial hy means of a machiue analogous to Mr Bahhage's, it is sufficient that there he $(m + 1)$ dials having the mutual relations we have indicated. Such is the nature of this machine, which, as it exists, is perfectly capahle of fulfilling the end originally proposed—of calculating numbers hy means of simple addition and subtraction. But the Analytical Engine—the mechanical notations of which alone cover five hundred large folio sheets of paper—is a much more elahorate invention, for while the Differenee Engine only tabulates, being incapable, by its nature to develop, the Analytical Engine is intended to either tabulate or develop; and, if constructed, could, as has been justly and elegantly observed, "weave algebraical patterns." But although Mr Babbage's Difference Engine has borne no fruit, it has been instrumental in grafting, so to speak, its powers on another machine which is performing valuable work in the Registrar-General's office at Somerset House; and this fact gives it very great additional interest. Ahout 1836 a Mr Scheutz, an eminent printer at Stockholm, having read an account of Mr Bahhage's Difference Engine, and heing fascinated by the subject, resolved to construct an engine for the same purposes. He has always honourahly avowed the origin of his idea, and that he is indehted to the account of Mr Bahhage's engine for his achievement. But great merit attaches to him, for he spent four years of hard labour and the greater portion of his fortune on a preliminary model. The result was so satisfactory, that although the Swedish Government was at first lukewarm, the Academy of Sciences at Stockholm hecame responsihle for the money, in the construction of which M. Scheutz was assisted hy his son, and the machine was completed and found to answer every expectation. A duplicate, but improved machine, has been made by Messrs Donkin for our Government, and it is now caleulating and *printing* a new English life-table, which will be of immense national value and importance. Unfortunately; the machine could not be spared to be exhibited alongside of Mr Bahhage's Difference Engine at the International Exhihition; hut near this are hung drawings of it; and specimens of the tables calculated, stereo-moulded, and printed by the Swedish machine, are exhibited in the case containing Mr Babhage's Difference Engine. These tables, which are beautifully clear, are well worth examining, as they prove, in the most demonstrative manner, that a large amount of what may be almost called intellectual power, has been given to the complicated machinery that has produced the tables in question. It is gratifying to record that the Messrs Scheutz have heen recompensed by their country. The King of Sweden has taken great interest in their machine, and the inventors received a gold medal at the last French International Exhibition. We are the more desirous that this should be generally known, because Mr Bahhage, who, as we have stated, has worked from first to last entirely without remuneration, has received no recompense whatever.—*The Parthenon.*

Iron for Purposes of Defence.—In what form and under what circumstances ean iron hest he applied for the security of our vessels and forts? To the latter the answer is, Make the hattery shields thick enough: hut a very different solution is required for the navy, where the weight aud thickness of the plates is limited to the earrying powers of the ship. It has been observed with some truth that we have learnt a lesson from the recent naval action ou the American waters; but it must he horne in mind that neither of the vessels engaged nor the ordnance employed were at all comparahle to what have heen used at Shoehuryness. To those who, like myself, have gone through the whole series of experiments, the late engagement will appear instructive, hut not calculated to cause any great alarm, nor yet effect any other changes than those primarily contemplated by the Government, and such as have been deduced from our own experiments. It is, nevertheless, quite evident that our future navy *must be entirely of iron*; and, judging from the last experiment with the Armstrong smooth-hore gun, it would almost appear as a problem yet to be solved, whether our ships of war are not as safe without iron armour as with it. If our new construction of ships are strong enough to carry armaments of 300-pounder guns, which is assumed to be the case, our plating of 6 or 7 inches thick would he penetrated, and probahly beeome more destructive to

those on board than if left to make a free passage through the ship. In this case we should be exactly in the same position as we were in former days with the wooden walls; but with this difference, that if built of iron the ship would not take fire and might be made shell proof. It is, however, very different with forts, where weight is not a consideration, and those I am persuaded may be made sufficiently strong to resist the heaviest ordnance that can be brought to bear against them. In this statement I do not mean to say that ships of war should not be protected; but we have yet to learn in what form this protection can be effected to resist the last powerful ordnance, and others of still greater force which are *looming in the distance*, and are sure to follow. A great outcry has been raised about the inutility of forts; and the Government, in compliance with the general wish, has suspended those at Spithead: I think improperly so; as the recent experiments at Shoeburyness clearly demonstrate that no vessel, however well protected by armour-plates, could resist the effects of such powerful artillery; and instead of the contest between the *Merrimac* and the *Monitor*, and that of the 300-pounder gun being against, they are to every appearance in favour of forts. Should this be correct, we have now to consider how we are to meet and how resist the smashing force of such powerful ordnance as was levelled against the *Warrior* target. During the whole of the experiments at Shoeburyness I have most intently watched the effects of shot on iron plates. Every description of form and quality of iron has been tried, and the results are still far from satisfactory; and this is the more apparent since the introduction of the large 300-pounder, just at a time when our previous experiments were fairly on the balance with the 40, 68, 100, and 126-pounders. They now appear worthless, and nothing is left but to begin our labours again *de novo*. It has been a question of great importance, after having determined the law of resistance and the requisite quality of the iron to be used as armour-plates, how these plates should be supported and attached to the sides of the ship. Great difference of opinion continues to exist on this subject,—some are for entirely dispensing with wood; probably the greater number contend for a wood backing, the same as the *Warrior* and the *Black Prince*. I confess myself in the minority on this question; and, judging from the experiments, I am inclined to believe from past experience that wood combined with iron is inferior to iron and iron in its power of resistance to shot; and I am fully persuaded that ultimately the iron armour-plates must be firmly attached to the side, technically called the skin, of the ship. It must, moreover, form part of the ship itself, and be so arranged and jointed as to give security and stability to the structure. The experiments instituted by the Committee on Iron Plates have been well considered and carefully conducted: they commenced with a series of plates selected from different makers, of varying thicknesses, and these have been tested both as respects quality and their powers of resistance to shot. They have, moreover, been placed at different angles and in a variety of positions, and we had just arrived at the desired point of security, when the thundering 300-pounder smooth-bore upset our calculations and levelled the whole fabric with the ground. We are, however, not yet defeated; and true to the national character, we shall, like the knights of old, resist to the last. Since the above was written, another experiment has been made on the *Warrior* target with the 300-pounder smooth-bore gun. From this it appears that the wood backing between the armour plates and the skin of the ship cannot safely be dispensed with, and that some compressible or softer substance than iron and iron is necessary to deaden the blow, and absorb the fragments of the shot and the broken plates, which in this instance lodged in the wood, and did not perforate.— *W. Fairbairn.*

Indian Railways.—During the past year an expenditure of about 7,000,000*l.* has been incurred, and 760 miles of new line have been opened for traffic. Of the East Indian Railway, 1,364 miles in length, 563 miles had been opened in January, 1862; of the Great Indian Peninsula, 1,266 miles long, 437 miles had been opened; of the Madras, 850 miles long, 298¾; of the Bombay and Baroda, 310 miles long, 132½; the Scinde, 114 miles long, had been wholly opened; of the Great Southern, 78½ miles in length, 48 had been opened; and of the Calcutta and South Eastern, 29 miles long, 16 had been opened. The first Punjab, 252 miles long; the second ditto, 280 miles; and the Eastern Bengal, 110 miles, are all in course of construction, and no part of them has yet been opened. Up to December last 2,459,928 tons of materials had been despatched to India by the railway companies. On this service 3,012 ships were employed, of which 39 have been lost. The value of the materials sent out was about 12,000,000*l.*, and the amount paid for insurance about 318,756*l.*, being on an average 2*l.* 12s. per cent. The total amount of losses sustained in the transport is about 250,000*l.*, being less than 2¼ per cent. on the value of the materials despatched. The losses were in each case fully covered. But, besides recovering from the underwriters 250,000*l.* for the materials lost, the companies also received considerable sums for general averages, so that the difference between the aggregate amount paid for premiums on insurance and the amount of losses was very small. On the 1st of January, 1861, the number of proprietors in the Indian railways was 17,118, and the paid-up capital, 25,887,050*l.* The year before it was 15,224, and the paid-up capital, 22,920,000*l.* During the past year the shareholders have increased to 19,469, and the share capital to 31,308,909*l.*, in addition to which 11,756,249*l.* is held in debentures by 6,621 persons. It is a noteworthy circumstance that, out of 34,329 persons employed on the open lines, on the 30th of October last, 32,148 were natives of the country. Between the 1st of May and the end of December a sum of 4,648,641*l.* had been raised by the companies, and this has been since increased by upwards of 4,000,000*l.* The Government were thus relieved from the necessity of raising any money on their behalf. While the sum thus raised by the companies has been more the expenditure has been less than was expected. It was calculated that 6,000,000*l.* would be spent in India and 2,000,000*l.* in England. In India the actual expenditure has been about 5,150,000*l.*; in England, 1,700,000*l.* The probable expenditure by the railway companies for the year 1862-3 may be taken to be 7,100,000*l.* Towards meeting this outlay there was a balance to the credit of the companies on the 1st of May of about 2,400,000*l.* There should be a balance of about 1,000,000*l.* on the 1st of May, 1863. To provide the whole amount thus required about 6,000,000*l.* will therefore have to be raised during the present year. Of the sum of 8,668,617*l.* raised during the past year, 3,745,838*l.* was by shares, and 4,922,779*l.* by debentures. At the beginning of the official year the share capital was 27,359,688*l.*, the debentures 6,835,770*l.*—total 34,395,458*l.* The whole amount of capital now issued accordingly reaches 43,065,890*l.*, consisting of shares or stock 31,308,641*l.*, debentures convertible into shares, 6,922,949*l.*, debentures, not convertible, 4,833,300*l.* Works, which will cost about 57,500,000*l.*, have been sanctioned; a sum of 53,500,000*l.*, has been guaranteed, and the remainder will be guaranteed as required. Of this 43,000,000*l.* has been raised, and of this last, 40,680,000*l.* has been expended. The average cost per mile, upon the whole, has been about 12,360*l.*; but before the railways are completely finished, including a small allowance of double lines, 13,000*l.* will probably be expended, and on this supposition the total capital required will be upwards of 60,000,000*l.* The sum paid by the railway companies out of their profits towards the liquidation of guaranteed interest only amounted to about 1,250,000*l.* The balance, more than 5,000,000*l.*, is recoverable by Government from half the net receipts in excess of 5 per cent. The annual amount due from the Government for interest is now upwards of 2,000,000*l.* The annual earnings of the railways for the year ending the 30th of June last, did not amount to a sixth of this sum, but a great portion of the capital to which the guaranteed interest applies is, of course, still altogether unproductive. The lines yielding the above profits do not represent half the capital which has been expended. The charge for conveying cotton by railway is now from 1d. to 1½d. per ton per mile. The mode hitherto adopted of carrying it by bullocks and in country carts involves an expense of about 3d. or 3½d. per ton per mile, and the cotton is so much injured during its transit that the cost of conveyance really amounts to about 4½d. per ton. The railway charges of 1d. and 1½d. exhibit, therefore, a very favourable contrast, and will enable the merchant to reduce the price at Manchester to 4*l.* or 4*l.* 10s. a ton, or nearly a halfpenny per lb. for all cotton brought from a distance of 300 miles in the interior. With regard to certain sections of railways, the execution of which had been suspended, its appears that arrangements have recently been made with the East Indian Railway Company, who have funds for the purpose, to commence operations on the branch of the East Indian Railway from Allahabad to Jubbulpore and that the Punjab Railway Company have been authorized to take measures for issuing shares to the extent of 2,500,000*l.* for the extension of the line from Lahore to Delhi, and to raise such an amount at once as shall be sufficient to allow the more formidable works, such as bridges, to be commenced this year. The approaching completion of the main lines has drawn the attention of Government and of the public to various schemes which, either directly or indirectly, should prove valuable auxiliaries to the railways. The first of these is a system of cross roads to connect the railway stations with the existing high roads of the country. This work has been vigorously undertaken by the local authorities in various districts. The Home Government has also recently sanctioned the execution, by the direct agency of local officers, of a light railway from the Iron Works on the Kumaon-hills to Koorjah in the Doab. These facts are gleaned from the official report recently issued by the Government Director of Indian Railway Companies.

Mr Glaisher's Balloon Ascent.—The balloon left Wolverhampton at 9.43 a.m., with the barometer at 29.50, and the temperature 55 deg. At 9.47 they got a temperature of 45 deg. At this time the air was dry, and the temperature began to decrease, till at 2 minutes after 10 it was 26 deg. The sun was then shining on the balloon with great brilliancy. In five minutes the temperature began to increase to 31 deg., and at a quarter past 10 it was 37 deg. On starting, Mr Coxwell's pulse was beating at 75 and Mr Glaisher's at 76, but at this time (10.15) Mr Coxwell's had risen to 86, and Mr Glaisher's to nearly 100. At this time the gas in the balloon, which previously had been opaque, became perfectly transparent, and, the neck being open, Mr Glaisher could see right through the gas to the top of the balloon. The proportions of the machine were observed to be accurate, and the netting clung tightly around it. Here also a striking change was observed in the surrounding scenery. From the pale light-blue colour of the sky below that which now surrounded them was an intensely deep Prussian blue. The *cumuli* clouds far below were very rocky in appearance, and the sun was shining upon their surface. The strati cloud was then at the same elevation as the balloon. The barometer at this time read 16 inches; and the temperature, continuing slowly to increase, was 38 deg. at 10.30. Now the barometer was reading less than 15 inches, showing that the aeronauts were nearly four miles high. Here palpitation of the heart was very perceptible, so much so that each man could hear the beating in the breast of the other. The ticking, too, of Mr Glaisher's watch was remarkably loud, reverberating like a chronometer beating upon a sounding board, and the rustling occasioned by the turning over the leaves of his notebook represented the rushing of a high wind. At 10.35, the temperature had increased to 42 deg., and they were at a height of four miles. Here the air was very dry. At this time it was remarked that the hands were dark blue, and the lips also blue, but not the face. Now the temperature began to decrease with wonderful rapidity. In four minutes it was reduced to 36 deg., and by 10.47 it was down to 31 deg. At 11.1 the highest elevation was reached. The barometer reading a little above 11 inches, it was evident that the voyagers had ascended to very nearly five miles. Here the temperature was 16 deg., and the breathing, which was observed to be interfered with when heart palpitation commenced, again became affected. A deep-blue sky was to be seen at this point, with clouds below, and the cold was felt. At 10.57 the feeling of sea-sickness, with its uncomfortable manifestations, came over Mr Glaisher, and at 11.7 the same feeling returned, but it was not so prolonged in duration. Mr Glaisher had been warned that at this

heigbt blood would issue from the nose, that the eyes would be affected, and there would be a tingling in the ears; but in neither the case of Mr Coxwell or himself were either of tbese manifestations perceived. During the last mile there was the extraordinary change of 26 deg. in the temperature. On the earth, it will he remembered, it was 55 deg., at half a mile it was 45 deg., at less than a mile it was 43 deg.; it then decreased to 26 deg.; at about two miles it increased constantly till the height of four miles was reached, when it was 42 deg.; and between four and five miles it rapidly decreased from 42 deg. to 16 deg. The air was dry throughout. At the highest elevation it was 80 deg. below zero. No dew was deposited. The dry hulb read 16 deg. and the wet hulb 9 deg. Reynault's hygrometer at zero had no dew; nor had Daniel's hygrometer any dew at 8 deg. below zero. No dew could be deposited at this elevation at either of the hygrometers. At half-past 11 Mr Coxwell become uneasy as to their position in relation to the coast, and at 11.42. when they were above the clouds, the earth was visible, and the Wash in the distance. The voyagers then brought their halloon and tbemselves down as quickly as possihle. In descending, the shadow of the balloon was seen on the clouds, and it continued to increase as the clouds were neared. In passing through the cloud tbe balloon could not he seen from the car, so dark was it. It was stated that they landed at Langham, near Oakham. The precise spot at which *terra firma* was again touched was a meadow near the boundary of the parishes of Langham and Ashwell, in Rutlandshire. They were seen descending by the residents in the neighbourhood, and by Mr E. G. Baker in particular. So rapidly were they coming down that Mr Baker prepared restoratives, and gave such orders as he feared would be called for on account of of what he expected would he the personal injuries which the voyagers would suffer. Happily, however, Mr Baker's kindness in this regard was scarcely nccessary, inasmuch as Mr Glaisher sustained only a slight injury to the face and hand, the inconvenience from which was merely a headache, and Mr Coxwell escaped altogether. The instruments, of conrse, were considerably injured, but not so much as on the last occasion. The rapidity with which tbe descent was made was chiefly owing to the effect upon the gas of the cold in the higher altitude, and on passing down through the clouds. The warmest hospitality was shown to the voyagers by Mr Baker. They arrived about midnight in Wolverhampton. The next ascent will be made when the wind has attained a westerly direction. The halloon proved all that could be expected, and Mr Coxwell feels satisfied that witb it he can reach an altitude of nearly six miles.

On Force.—A highly interesting lecture on this subject was recently delivered by J. Tyndall, Esq., F.R.S., Prof. of Nat. Philosophy, Roy. Inst.

We all have ideas more or less distinct regarding force; we know in a general way what muscular force means, and each of us would less willingly accept a blow from a pugilist than have his cars boxed hy a lady. But these general ideas are not now sufficient for us; we must learn how to express numerically the exact mechanical value of the two blows; this is the first point to be cleared up.

A sphere of lead weighing 1 lb. was suspended at a height of 16 feet above the theatre floor. It was liberated, and fell by gravity. That weight required exactly a second to fall to the earth from that elevation; and the instant before it touched the earth, it had a velocity of 32 feet a second. That is to say, if at that instant the earth were annihilated, and its attraction annuled, the weight would proceed through space at tbe uniform velocity of 32 feet a second.

Suppose that instead of being pulled downward hy gravity, the weight is cast upward in opposition to the force of gravity, with what velocity must it start from the earth's surface in order to reach a height of 16 feet? With a velocity of 32 feet a second. This velocity imparted to the weight by the human arm, or by any other mechanical means, would carry the weight up to the precise height from which it has fallen.

Supposing, now, that instead of imparting a velocity of 32 feet a second to the weight we impart twice this speed, or 64 feet a second. To what height will the weight rise? You might be disposed to answer, "To twice the height;" but this would be quite incorrect. Both theory and experiment inform us that the weight would rise to four times the height; instead of twice 16, or 32 feet, it would reach four times 16, or 64 feet. So also, if we treble the starting velocity, the weigbt would reach nine times the height; if we quadruple the speed at starting, we attain sixteen times the height. Thus, with a velocity of 128 feet a second at starting, the weight would attain an elevation of 256 feet. Supposing we augment the velocity of startiug seven times, we should raise the weight to 49 times the height, or to an elevation of 784 feet.

Now the work done—or, as it is sometimes called, the *mechanical effect*—as before explained, is proportional to the height, and as a double velocity gives four times the height, a trehle velocity nine times the height, and so on, it is perfectly plain that the mechanical effect increases as the square of the velocity. If the mass of tbe body be represented by the letter m, and its velocity by v, then the mechanical effect would he represented by $m v^2$. In the case considered, I have supposed the weight to be cast upward, being opposed in its upward flight by the resistance of gravity; but the same holds trne if I send tbe projectile into water, mud, earth, timber, or otber resisting material. If, for example, you double the velocity of a cannon-ball, you quadruple its mechanical effect. Hence the importance of augmenting the velocity of a projectile, and hence the philosophy of Sir William Armstrong in using a 50 lb. charge of powder in his recent striking experiments.

The measure then of mechanical effect is the mass of the body multiplied by tbe square of its velocity.

Now in firing a ball against a target tbe projectile, after collision, is often found hissing hot. Mr Fairbairn informs me that in the experiments at Shoehuryness it is a common thing to see a flash of light, even in hroad day, when the ball strikes the target. And if I examine my lead weight after it has fallen from a heigbt I also find it heated. Now here experiment and reasoning lead us to the remarkable law that the amount of heat generated, like the mechanical effect, is proportional to the product of the mass into the square of the velocity. Double your mass, other things heing equal, and you double your amount of heat; double your velocity, other things remaining equal, and you quadruple your amount of heat. Here then we have common mechanical motion destroyed and heat produced. I take this violin bow and draw it across this string. You hear the sound. That sound is due to motion imparted to the air, and to produce that motion a certain portion of the muscular force of my arm must he expended. We may here correctly say, that the mechanical force of my arm is converted into music. And in a similar way we say that the impeded motion of our descending weight, or of the arrested cannon-ball, is converted into heat. The mode of motion changes, but it still continues motion; *the motion of the mass is converted into a motion of the atoms of the mass;* and these small motions, communicated to the nerves, produce the sensation which we call heat. We, moreover, know the amount of heat which a given amount of mechanical force can develop. Our lead ball, for example, in falling to the earth generated a quantity of heat sufficient to raise the temperature of its own mass three-fifths of a Fahrenheit degree. It reached the earth with a velocity of 32 feet a second, and forty times this velocity would be a small one for a rifle bullet; multiplying three-fifths by the square of 40, we find that the amount of heat developed hy collision with the target would, if wholly concentrated in the lead, raise its temperature 960 degrees. This would he more than sufficient to fuse the lead. In reality, however, the heat developed is divided between the lead and the body against which it strikes; nevertheless, it would be worth while to pay attention to this point, and to ascertain whether rifle bullets do not, under some circumstances, show signs of fusion.

The researches of Sir John Herschel and M. Pouillet have informed us of the annual expenditure of the sun as regards heat; and by an easy calculation we ascertain the precise amount of the expenditure which falls to the share of our planet. Out of 2300 million parts of light and heat the earth receives one. The whole heat emitted hy the sun in a minute would he competent to hoil 12,000 millions of cubic miles of ice-cold water. How is this enormous loss made good? Whence is the sun's heat derived, and by what means is it maintained? No combustion, no chemical affinity with which we are acquainted would be competent to produce the temperature of the sun's surface. Besides, were the sun a burning body merely, its light and heat would assuredly speedily come to an end. Supposing it to be a solid globe of coal, its combustion would only cover 4600 years of expenditure. In this short time it would burn itself out. What agency then can produce the temperature and maintain the outlay? We have already regarded the case of a body falliug from a great distance towards the earth, and found that the heat generated by its collision would be twice that produced hy the combustion of an equal weight of coal. How much greater must be the heat developed by a body falling towards the sun? The maximum velocity with which a body can strike the earth is about 7 miles in a second; the maximum velocity with which it can strike the sun is 390 miles in a second. And as the heat developed hy the collision is proportional to the square of the velocity destroyed, an asteroid falling into tbe sun with the above velocity would generate about 10,000 times tbe quantity of heat generated by the combustion of an asteroid of coal of the same weight. Have we any reason to believe that such bodies exist in space, and that they may he raining down upon the sun? The meteorites flashing through the air are small planetary hodies, drawn by the earth's attraction, and entering our atmosphere with planetary velocity. By friction against the air they are raised to incandescence and caused to emit light and heat. At certain seasons of the year they shower down upon us in great numbers. In Boston 240,000 of them were observed in nine hours. There is no reason to suppose that the planetary system is limited to "vast masses of enormous weight;" there is every reason to believe that space is stocked with smaller masses, which obey the same laws as tbe large ones. That lenticular envelope which surrounds the sun, and which is known to astronomers as the Zodiacal light, is probably a crowd of meteors; and moving as they do in a resisting medium they must continually approach the sun. Falling into it, they would he competent to produce tbe heat observed, and this would constitute a source from which the annual loss of heat would be made good. The sun, according to this hypothesis, would he continually growing larger; hut how much larger? Were our moon to fall into the sun it would develop an amount of heat sufficient to cover one or two years' loss; and were our earth to fall into tbe sun a century's loss would he made good. Still, our moon and our earth, if distributed over the surface of the sun, would utterly vanish from perception. Indeed, the quantity of matter competent to produce the necessary effect would, during the range of history, produce no appreciable augmentation in the sun's magnitude. The augmentation of the sun's attractive force would be more appreciable. However this hypothesis may fare as a representant of what is going on in nature, it certainly shows how a sun might he formed and maintained by the application of known thermo-dynamic principles.

Our earth moves in its orbit with a velocity of 68,040 miles an hour. Were this motion stopped, an amount of heat would be developed sufficient to raise the temperature of a globe of lead of the same size as the earth 384,000 degrees of the centigrade thermometer. It has been propbesied that "the elements shall melt with fervent heat." The earth's

own motion embraces the conditions of fulfilment; stop that motion, and the greater part, if not the whole, of her mass would be reduced to vapour. If the earth fell into the sun, the amount of heat developed by the shock would be equal to that developed by the combustion of 6435 earths of solid coal.

There is one other consideration connected with the permanence of our present terrestial conditions, which is well worthy of our attention. Standing upon one of the London bridges, we observe the current of the Thames reversed, and the water poured upward twice a-day. The water thus moved rubs against the river's bed and sides, and heat is the consequence of this friction. The heat thus generated is in part radiated into space, and then lost, as far as the earth is concerned. What is it that supplies this incessant loss? The earth's rotation. Let us look a little more closely at the matter. Imagine the moon fixed, and the earth turning like a wheel from west to east in its diurnal rotation Suppose a high mountain on the earth's surface; on approaching the moon's meridian, that mountain is, as it were, laid hold of by the moon, and forms a kind of handle by which the earth is pulled more quickly round. But when the meridian is passed the full of the moon on the mountain would be in the opposite direction, it now tends to diminish the velocity of rotation as much as it previously augmented it; and thus the action of all fixed bodies on the earth's surface is neutralized. But suppose the mountain to lie *always* to the east of the moon's meridian, the pull then would be always exerted against the earth's rotation, the velocity of which would be diminished in a degree corresponding to the strength of the pull. *The tidal wave occupies this position*—it lies always to the east of the moon's meridian, and thus the waters of the ocean are in part dragged as a brake along the surface of the earth; and as a brake they must diminish the velocity of the earth's rotation. The diminution, though inevitable, is, however, too small to make itself felt within the period over which observations on the subject extend. Supposing then that we turn a mill by the action of the tide, and produce heat by the friction of the millstones; that heat has an origin totally different from the heat produced by another mill which is turned by a mountain stream. The former is produced at the expense of the earth's rotation, the latter at the expense of the sun's radiation.

The sun, by the act of vaporization, lifts mechanically all the moisture of our air. It condenses and falls in the form of rain,—it freezes and falls as snow. In this solid form it is piled upon the Alpine heights, and furnishes materials for the glaciers of the Alps. But the sun again interposes, liberates the solidified liquid, and permits it to roll by gravity to the sea The mechanical force of every river in the world as it rolls towards the ocean, is drawn from the heat of the sun. No streamlet glides to a lower level without having been first lifted to the elevation from which it springs by the mighty power of the sun. The energy of winds is also due entirely to the sun; but there is still another work which he performs, and his connection with which is not so obvious. Trees and vegetables grow upon the earth, and when burned they give rise to heat, and hence to mechanical energy. Whence is this power derived? You see this oxide of iron, produced by the falling together of the atoms of iron and oxygen; here also is a transparent gas which you cannot now see—carbonic acid gas—which is formed by the falling together of carbon and oxygen. These atoms thus in close union resemble our lead weight while resting on the earth; but I can wind up the weight and prepare it for another fall, and so these atoms can be wound up, separated from each other, and thus enabled to repeat the process of combination. In the building of plants carbonic acid is the material from which the carbon of the plant is derived; and the solar beam is the agent which tears the atoms asunder, setting the oxygen free, and allowing the carbon to aggregate in woody fibre. Let the solar rays fall upon a surface of sand; the sand is heated, and finally radiates away as much heat as it receives; let the same beams fall upon a forest, the quantity of heat given back is less than the forest receives, for the energy of a portion of the sunbeams is invested in building up the trees in the manner indicated. Without the sun the reduction of the carbonic acid cannot be effected, and an amount of sunlight is consumed exactly equivalent to the molecular work done. Thus trees are formed; thus the cotton on which Mr Bazley recently discoursed is formed. I ignite this cotton, and it flames; the oxygen again unites with its beloved carbon; but an amount of heat equal to that which you see produced by its combustion was sacrificed by the sun to form that bit of cotton.

But we cannot stop at vegetable life, for this is the source, mediate or immediate, of all animal life. The sun severs the carbon from its oxygen; the animal consumes the vegetable thus formed, and in its arteries a reunion of the severed elements take place, and produce animal heat. Thus, strictly speaking, the process of building a vegetable is one of winding up; the process of building an animal is one of running down. The warmth of our bodies, and every mechanical energy which we exert, trace their lineage directly to the sun. The fight of a pair of pugilists, the motion of an army, or the lifting of his own body up mountain slopes by an Alpine climber, are all cases of mechanical energy drawn from the sun. Not, therefore, in a poetical, but in a purely mechanical sense, are we children of the sun. Without food we should soon oxidize our own bodies. A man weighing 150 lbs. has 64 lbs. of muscle; but these, when dried, reduce themselves to 15 lbs. Doing an ordinary day's work, for 80 days, this mass of muscle would be wholly oxidized. Special organs which do more work would be more quickly oxidized: the heart, for example, if entirely unsustained, would be oxidized in about a week. Take the amount of heat due to the direct oxidation of a given amount of food; a less amount of heat is developed by this food in the working animal frame, and the missing quantity is the exact equivalent of the mechanical work which the body accomplishes.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING JULY 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	D	£	s	D	£	s.	D.	£	s.	D.
Bars, &c., British, per ton,	5	15	0	5	15	0	5	15	0	5	15	0
Nail Rods,	7	5	0	7	10	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	15	0
Sheets,	8	10	0	8	10	0	9	0	0	9	5	0
Pig, No 1, Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	0	0	7	0	0	7	0	0
Rails,	5	7	6	5	10	0	5	10	0	5	10	0
Pig, No. 1, Clyde,	2	11	9	2	12	0	2	11	0	2	12	0
Swedish in bond,	11	5	0	11	15	0	11	15	0	11	15	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	0	0
In faggots,	17	0	0	17	0	0	17	0	0	16	10	0
SPELTER, ingot,	17	10	0	17	15	0	17	10	0	17	10	0
ZINC, sheet,	23	10	0	23	15	0	24	0	0	24	0	0
COPPER.												
Sheathing bolts, pr lb.,	0	0	11	0	0	10¾	0	0	10¾	0	0	10½
Bottoms,	0	0	11	0	0	11	0	1	0	0	0	11
Old,	0	0	9¼	0	0	9	0	0	9	0	0	9
Tough Cake, per ton,	93	0	0	93	0	0	93	0	0	92	0	0
Tile,	93	10	0	93	0	0	94	0	0	94	0	0
TIN.												
English blocks, per ton, duty free,	116	0	0	116	0	0	114	0	0	114	0	0
Bars in barrels,	119	0	0	119	0	0	115	0	0	115	0	0
Refined,	119	0	0	119	0	0	119	0	0	119	0	0
Banca, in bond,	121	0	0	121	0	0	121	0	0	121	0	0
Straits, ditto,	114	0	0	114	0	0	114	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	2	6	1	2	6	1	2	6
LEAD.												
English pig,	20	0	0	21	0	0	21	5	0	21	5	0
Sheet,	21	0	0	21	10	0	20	10	0	21	10	0
Spanish pig, in bond,	19	10	0	19	15	0	20	0	0	20	0	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	3	15	0	3	10	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	15	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	10	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	10	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	42	0	0	42	0	0	42	0	0	42	0	0
" yellow,	34	0	0	35	0	0	37	0	0	37	0	0
Sperm,	90	0	0	90	0	0	92	10	0	92	0	0
Cod,	39	10	0	40	0	0	40	0	0	40	0	0
South Sea,	36	0	0	37	0	0	37	0	0	37	0	0
Olive, Gallipoli, per tun,	56	10	0	57	0	0	57	6	0	57	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	49	10	0	50	10	0	50	0	0	50	0	0
Rape pale foreign,	52	0	0	52	0	0	52	0	0	53	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt.	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	34	10	0	34	0	0	34	0	0
Jute,	14	0	0	13	10	0	14	10	0	14	10	0
Hemp Rope,	24	10	0	24	0	0	24	0	0	24	5	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

1417. Gustave Fuhrmann, Paris—Boring cast steel barrels.
1418. William Clark, Chancery Lane—Fire grates.—A com.
1419. J. B. Pope, Leeds—Loading coals.
1420. C. J. Harris, King William Street—Tickets.
1421. H. S. Firman, Great Suffolk Street—Cleansing textile fabrics.—A com.
1422. J. H. Johnson, Middlesex and Glasgow. Casting metals.—A com.
1423. Henry Bayley, Stalybridge, Leopold Newton, Oldham, and John Greaves, Stalybridge—Turning, boring, and cutting wood, &c.
1424. Henry Cartwright, Dean Brosely, Salop—Propelling.
1425. W N. Hutchinson, Plymouth—Screw propelled ships.
1426. C. J. Neale, High Oakham. Nottingham—Measuring grain.
1427. Handel Ashworth, Hyde, Cheshire—Carding cotton.
1428. J. L. Wilson, St. John Street—Calendering.
1429. A. B. Freeland, Chatham Terrace—Preparation of hops.
1430. E. F. Lansky, Sheffield—Railway brakes.
1431. Thomas Bucknicy, Peckham Rye—Time keepers.—A com.

13th May, 1862.

1432. S. B. Ardrey, Birmingham, and Samuel Beckett, Oldham—Spindles.
1433. J. H. Johnson, Middlesex and Glasgow—Engineering work.—A com.
1434. J. D. Gavillet and J. P. F. Gandon, Paris—Paddle wheels.
1435. P. M. Lopez, Paris—Sowing grain or seeds.
1436. J. B. Sardy, New York—Ships of war.
1437. W. E. Newton, Chancery Lane—Coffee pots and boilers.—A com.
1438. Arthur Wormull, Old Fish Street—Trepanning instruments.
1439. Gideon Blake, Trowbridge—Warming apartments.
1440. J. H. Johnson, Middlesex and Glasgow—Purification of oils.—A com.
1441. R. A. Boyd, Southwark—Bacon.
1442. James Sivenright, Ravenhead, Lancashire—Plate glass.
1443. William Clark, Chancery Lane—Raising and forcing water.—A com.
1444. William Harticau, Brighton—Fire escape apparatus.
1445. R. A. Brooman, Fleet Street—Shunting trains.—A com.
1446. R. A. Brooman, Fleet Street—Blinds or shutters.—A com.
1447. William Southwood, Kensington—Nails.
1448. R. M. Latham, Fleet Street—Steering apparatus.—A com.
1449. Michael Henry, Fleet Street—Gloves.—A com.

14th May, 1862.

1450. C. T. Porter, New York, U.S.—Indicators.—A com.
1451. H. C. R. Joubert, Maddox Street—Music stool or seat.
1452. Frederick Tolhausen, Paris—Velvets.—A com.
1453. R. A. Brooman, Fleet Street—Photographic portraits.—A com.
1454. J. W. Girdlestone, Birkenhead—Projectiles.
1455. Henry Deacon, Appleton, Lancashire—Colours.
1456. Andrew Smith, Mauchline—Balances.
1457. Edwin Whittaker and Jeremiah Clare, Hurst—Preparing cotton.
1458. H. D. Delvigne, Paris—Fire-arms.
1459. John Smith, Coven—Thrashing machines.
1460. J. C. Brant, Forston Street—Armour plated ships.
1461. Adolphe Nicole, Soho Square—Watches and time keepers.

15th May, 1862.

1462. James Fletcher and J. W. Fuller, Salford—Rolling metals.
1463. T. H. Le Mesurier, Guernsey—Raising sunken vessels.
1464. G. H. Sanborn, Fleet Street—Spinning.—A com.
1465. R. and J. Walsham, Birmingham—Sleeve fastener.
1466. J. P. Jouvin, France—Preserving iron vessels from oxidation.
1467. John Dicker, Hendon—Delivery of bags from railway trains in motion.
1468. William Sissons, Kingston-upon-Hull—Driving piles.
1469. G. H. Birkbeck, Southampton Buildings—Consuming smoke—A com.
1470. Josiah Stone, Deptford—Ship pumps and fire engines.
1471. James Wright, Bridge Street—Travelling crane.—A com.
1472. James Wright, Bridge Street—Digging and excavating.—A com.
1473. Charles Attwood, Durham—Steel and iron.
1474. Cooper Tress, Blackfriars Road—Hats, helmets, and caps.
1475. Isham Baggs, Middlesex, and W. Simpson, Maidstone—Vegetable fibres.
1476. Charles Girardet, Vienna—Improved buckle.
1477. Alfred Watney, Upper Berkeley Street—Shot-resisting ships and vessels.

16th May, 1862.

1478. P. M. Parsons, Blackheath—Ordnance and fire-arms.
1479. J. & T. Railton, Blackburn—Warping machines.
1480. George Haseltine, Fleet Street—Churns.—A com.
1481. Rest Fenner, Fleet Street—Folding envelopes.
1482. Richard Laming, Priory Road—Electric telegraphs.
1483. Christopher Binks, Parliament Street—Treating oils.
1484. A. A. Lamiable, Paris—Cast steel.
1485. A. L. Thirion, Belgium—Carriages.
1486. F. B. Anderson, Birmingham—Watches and time-keepers.
1487. D. C. Le Souëf, Twickenham—Embossing metal plates.—A com.
1488. George Davies, Serle Street—Ribs for umbrellas.—A com.
1489. Samuel Peberdy, Philadelphia, U.S.—Knitting ribbed fabrics.
1490. Nathan Ames, Sangus, U.S.—Curd printing press.
1491. Nathan Thompson, Abbey Gardens—Stoppers for bottles.
1492. Frederick Stocken, Halkin Street—Carriages.
1493. Benjamin Sharpe, Hanwell Park—Ships and vessels.
1494. A. V. Newton, Chancery Lane—Cutting leather.—A com.
1495. A. V. Newton, Chancery Lane—Boot and shoe soles.—A com.

17th May, 1862.

1496. Christopher Binks, Parliament Street—Oxygen and chlorine gases.
1497. R. W Seivier, Guildford Street—Naval warfare.
1498. Robert Davison, and Thomas Johnson, Bermondsey—Washing casks.
1499. E. Tailbouis, Paris—Knitting frames.
1500. James Hogg, Orleans Villas—Book-covers.
1501. James Broadley, Saltaire—Weaving
1502. J. C. Hill and David Caddick, Monmouthshire—Puddling furnaces.
1503. Joseph Needham, Piccadilly—Sheathing slips.
1504. C. H Tessier, Paris—Safety lock—A com.
1505. E. J. Bridell, Middle Temple—Artificially coloured substances.
1506. F E. Sickels, New York, U.S.—Steering vessels.
1507. J. C. Gore, Norfolk, U S.—Improvement in belt shippers.

19th May. 1862.

1508. James Wright, Bridge Street—Sheathing ships.
1509. James Eastwood, Blackburn—Wringing yarns.
1510. Robert Ramsden, Kingsland Road—Mashing malt.
1511. George Macdonald, Bengal—Fibre huffs
1512. F. C. Kirkman, Crouchend, and Richard Swift, Hounslow—Fixing posts.
1513. W. Pickstone, Radcliffe, and Thomas Mellodew, Oldham—Cord or corduroy.
1514 Jesse Lee, Church Gate, Leicestershire—Traction engines.
1515. Timothy Morris, Robert Weare, and E H. C. Monckton, Trafalgar Square—Protection of life and property by electricity.
1516. Timothy Morris, Robert Weare, and E H. C. Monckton, Trafalgar Square—Obtaining light and heat by electricity.
1517. A V. Newton, Chancery Lane—Splitting leather.—A com.

20th May, 1862.

1518 M. A. F Mennons, Paris—Breech-loading fire-arms.—A com.
1519. M. A. F. Mennons, Paris—Screw power to railway trains.—A com.
1520. M. A. F. Mennons, Paris—Conversion of amylaceous matters into saccharine and other useful products.—A com
1521. William Naylor, Queen's Road—Forging metals.
1522. Rebecca Tallerman and L. A. Tallerman, Bishopsgate Street Without—International ladies' companions.
1523. James Taylor, Fenchurch Street—Abstracting heat from liquids, &e.
1524. William Clark, Chancery Lane—Hydraulic wheels.—A com.
1525. Edward Fewtrell, Birmingham—Metal tubes.
1526. Maurice Vogl, Sambrook Court—Proteeting houses.
1527. John Kennedy, Whitehaven—Ship propellers.
1528. William Petrie, Charlton—Vessels for boiling chemical produets.

21st May, 1862.

1529. H B. Barlow, Manchester—Presses for cotton.—A com.
1530. John Hopkinson, Regent Street—Pianofortes.
1531. John Kennedy, Whitehaven—Plating ships and vessels.
1532. W. H. Burnett, Margaret Street—Working telegraphic lines.
1533. M. A. Le Brun Virloy, Paris—Carbonizing fuel.
1534. William Bush, Tower Hill—Armour for ships and batteries.
1535. Alfred Giles, Adelphi Terrace—Floating breakwaters.
1536. Louis Leins, Bucklersbury—Travelling bags.
1537. H. C. Meyer, Ashford Street—Stopping carriages.
1538. W. E. Newton, Chancery Lane—Mineralized fabrics.—A com.

22d May, 1862.

1539. John Oxley, Old St. Pancras Road—Wheels.
1540. C. W. Siemens, Great George Street—Telegraph apparatus.
1541. J H. Perry, Piccadilly—Curing diseases by magnetism.
1542. E. De la Bastida, Hart Street—Designs in relievo.—A com.
1543. George Crawford, Beaumont Street—Musical instruments.
1544 Joseph Needham, Piecadilly—Fire-arms and cartridges.
1545. S. and F. Turnbull, Shoreditch—Floorcloths.
1546. John Kennedy, Whitehaven—Protecting ships.
1547. A. B. Childs, New Oxford Street—Wringing machines.—A com.
1548. P. R. Hodge. Tokenhouse Yard—Dessert plate.
1549. George Barlow, Birmingham—Submarine telegraphic cables.—A com.
1550. Henry Cook, Manchester—Electric batteries—A com.
1551. William Roberts and Thomas Greenacre, Millwall—Cocks or valves.
1552. William Evans, Commercial Road East—Motive power.
1553. G. F. Göransson, Gefle, Sweden—Arming vessels, &c.

23d May, 1862.

1554. Peter M'Gregor, Manchester—Spinning and doubling.
1555. Robert Blacklidge, Accrington, Lancashire—Sizing yarns and colours.
1556. C. De Berque, Manchester—Metal reeds for weaving.
1557. W. E Wiley, Birmingham—Penholders.
1558. James Webster, Birmingham—Coating metals.
1559. Joseph Ward, Radford, and John Dewick, New Lenton—Looped fabrics.
1560. Eugene Mouline, Vals, France—Weaving.
1561. Edwin Maw, Leamington—Ships and batteries.
1562. Alexander Samuelson, Cornhill—Hydrostatic presses.
1563. William Clark, Chancery Lane—Stockings.—A com.

26th May, 1862.

1564. G T. Livesey, Old Kent Road—Purifying gas
1565. John Harrison and Robert Parkinson, Blackburn—Spinning and weaving.
1566. W. J. Harrison, J. Oddie, and W. Parkinson, Blackburn—Weaving.
1567. C. De Berque, Manchester—Iron framing.
1568. Christopher Brakell, W. Hoehl, and W. Gunther, Oldham—Engines.
1569. Mark Walls and John Crompton, Bolton—Railway signals.
1570. Jacob Taylor, Oldham—Preparing cotton.
1571. Walter Brierley and G. F. Smeeton, Halifax—Targets.
1572. William Clark, Chancery Lane—Fastening buttons.—A com.
1573. William Worby, Ipswich—Reaping machines.
1574. J A. C. N. Delpech, Castres—Pumps.
1575. R. M. Letchford, Bethnal Green—Matches.
1576. G. A. Huddart, Brynkir, Carnarvon—Superheating steam.
1577. J. E. Holmes, New York, U.S.—Cultivating land.
1578. J. E. Holmes, New York, U.S.—Cultivating land.—A com.
1579. J. E. Holmes, New York, U.S —Printing machinery.—A com.
1580. T. D. T. Sparrow, Piccadilly—Shading street lights.

27th May, 1862.

1581. Edmund Tuck, Leadenhall Street—Electrical manipulation.
1582. C. A. M. Durand, Penjard, France—Water-mill.
1583. W. E. Gedge, Wellington Street—Wire ropes.—A com.
1584. John Halliday, Manchester—Trimmings.
1585. Jonathan Ireland, Manchester—Moulds for card cylinders.
1586. H. D. P. Cunningham, Bury Honse, Alverstoke—Anchors.
1587. William Clark, Chancery Lane—Brakes.—A com.
1588. Frederick Tolhansen, Paris—Wire gauze.—A com.
1589. G. H. Sauborn, Boston, U.S.—Fire-arms.—A com.
1590. John Hay, Troon—Ships and batteries.
1591. John Duffus, Cullen, Banff—Measuring piece goods.
1592. William Palmer, New York, U S.—Fire-arms.
1593. D. T. Moss, Leeds—Horse shoes.
1594. G. H. Daw, Threadneedle Street—Fire-arms.
1595. C. H. Hudson, Roxbury, Norfolk, U.S.—Defensive armour.

28th May, 1862.

1596. Henry Eaton, Manchester—Baling presses.

1597. J. H. Kidd, Manchester—Waterproofing fabrics.
1598. James Simpson, Hulme, Lancashire—Mouldings.
1599. John Rogerson, Newcastle-upon-Tyne—Iron floating dock.
1600. Charles Cohen, Bury Street—Umbrella and other like sticks.
1601. J. F. Harrison, Cambridge Square—Preserving ships' bottoms.
1602. Ralph Martindale, Birmingham—Globes and glasses for lamps.
1603. Thomas Turner, Redditch—Polishing needles.
1604. Henry Saunders and J. H. Mills, Birmingham—Venetian blinds.
1605. John Hirst, Dobcross, and E. O. Taylor, Marsden—Evaporating water.
1606. R. A. Brooman, Fleet Street—Looms.—A com.
1607. J. H. Johnson, Middlesex and Glasgow—Tinned lead pipes.—A com.
1608. William Blackmore, Foynes, and Henry Lamb, Ennis—Burning limestone.
1609. J. A. Ransome, Ipswich, Suffolk—Railway chairs.

20th May, 1862.

1610. John Critchley, Manchester—Umbrellas and parasols.
1611. John Hirst, Dobcross, and Joseph Wood, Birkby—Stereoscopic apparatus.
1612. Pierre Boisset and Bernardo Antognini, New York, U.S.—Boots and shoes.
1613. Henning Boetius, Great George Street—Cooling liquids.
1614. George Ashton, Heywood—Dyeing.
1615. J. D. Lee and James Crabtree, Shipley—Looms.
1616. William Perks, Birmingham—Metallic sash Bars.
1617. C. D. Abel, Chancery Lane—Exhausting air, water, or gases.—A com.
1618. Robert Griffiths, Mornington Road—Propellers and sheathing ships
1619. John Paterson, Wood Street—Instrument for binding or stitching.
1620. William Clark, Chancery Lane—Shuttles of looms.—A com.
1621. Na haniel Lawton and R. P. Whitworth, Stalybridge—Engines for carding.
1622. Samuel Minton, Isleworth—Revolving battery.

30th May, 1862.

1623. William Footman, Great Queen Street—Sewage and liquid manures.
1624. Florimond Datichy and Eugene Sabatier, Mortimer Street—Paper pulp.
1625. P. U. Payras, Paris—Protecting dry skins from vermin.
1626. James Gurrin, Stroud—Domestic telegraphing.
1627. Richard Nicholson, Ripon, Yorkshire—Mowing machines.
1628. Isopy Leon, Paris—A stopping rein.
1629. John Morrison, Birmingham—Springs for ladies' dresses or crinolines.
1630. C. O. Staunton, Chelsea—Signalling on targets in rifle practice.
1631. H. P. Burt, Charlotte Row—Protecting woodeu posts from decay.
1632. R. C. Steed, Aylesford Street—Signalling on railways.
1633. T. N. Pengelly and William Byron, Charlotte Street—Hoisting goods.
1634. William Eddington, Chelmsford—Draining and tilling land,
1635. R. E. Lofft, Bury St. Edmonds—Fire-arms and cartridges.
1636. Julius Ives, New York, U.S.—Washing fabrics.

31st May, 1862.

1637. Alfred Gilbey, Oxford Street—Cases for bottles.
1638. J. H. Holland, Lorrimore Road—Traction engines.
1639. Godfrey Ermen and Robert Smith, Manchester—Balling fibrous materials.
1640. W. T. Smallwood, and William Wright, Dean's Buildings—Water closets
1641. Alexis Moreau and A. E. Ragon, Bernard Street—Electro-magnetic machines.
1642. T. V. de Veye, Paris—Protecting iron from rust.
1643. Robert Shortrede, Brighton—Pressing cotton.
1644. D. A. Lamb, Berwick-upon-Tweed—Railway buffers.
1645. H. Watson, Newcastle, and Joseph Millbourn, Dartford—Pulp strainers.
1646. Joseph Betteley, Liverpool—Ship building
1647. Ignazio Villa, Denmark Street—Exhibiting astronomical phenomena.
1648. T. T. Lawden, Birmingham—Single and doubled barrelled guns
1649. G. C. Lingham and Joseph Nicklin, Birmingham—Crinoline connector.
1650. Leopold Chauhart, Moissac, France—Raising the level of water.
1651. W. E. Newton, Chancery Lane—Treatment of cloth and leather.—A com
1652. W. K. Sullivan, Dublin—Preservation of stone.
1653. W. E. Newton, Chancery Lane—Shot proof gun towers.—A com.

2d June, 1862.

1654. Benjamin Templar, Manchester—Registering billiard games.
1655. James King and John Partington, Rochdale—Looms.
1656. John Elce and W. J. Gradwell, Manchester—Spinning and winding.
1657. A. J. Sax, Paris—Drums
1658. Thomas Campbell, Leeds—"Witneying" piled fabrics.
1659. C. H. Roeckner, Bristol—Coffer dams.
1660. Joseph Baker, Coatbridge—Pumps.
1661. John Key and Ferdinand Potts, Birmingham—Designs in iron.
1662. C. E. Gray, Great Suffolk Street—Oleaginous and fatty matters.
1663. Joseph Whitworth, Manchester—Shells.
1664. W. E. Newton, Chancery Lane—Handles of shovels, spades, &c.—A com.
1665. Edward Lloyd, Bow Paper Mills, Middlesex—Paper.
1666. A. V. Newton, Chancery Lane—Cleaning flax.—A com.
1667. John Marson, Birmingham—Projectiles.
1668. J. J. H. Gebhardt, Lawrence Lane—Fastening for bags and purses.—A com.

3d June, 1862.

1669. T. L. Scowen, Stoke Newington—Ocular demonstrator of time in music.
1670. Goldsworthy Gurney, Bude, Cornwall—Artificial light.
1671. W. H. Hall, Birmingham—Miners' safety lamps.
1672. R. A. Kemp, Harrow Road—Harmoniums.
1673. John Biers, Tottenham Court Road—Horse shoes.
1674. Stringer Weston, Tenterden, Kent—Trusses
1675. J. L. Norton, Belle Sauvage Yard—Forcing water.
1676. John Fincham, Mildenhall, Suffolk—Repairing roads and tilling land.

4th June, 1862.

1677. A. H. Perry, Brighton—Securing railway chairs.
1678. George Peel and Joseph Simpson, Manchester—Hydraulic presses.
1679. C. S. Cahill, Gerrard Street—Felted fabrics.
1680. William James, Dudley—Bolts, spikes, and nails.
1681. Thomas Allcock, Ratcliffe-on-Trent—Horse rakes.
1682. Richard Roe, Friargate—Planes for working sash fillisters.
1683. George Allibon and Edward Snell, Lewisham—Surface condensers.
1684. G. B. Toselli, Threadneedle Street—Cooling liquids.
1685. I. and G. Battinson, Halifax—Combing wool.
1686. G. H. Sanborn, Boston, U.S.—Refrigerators.—A com.
1687. F. P. Preston, New Cross, and Charles Goodman, Deptford—Railways.
1688. Edward Schentz, Brompton—Rotatory engines.
1689. Samuel Huston, Deeping, Leicester—Safety valves.
1690. A. V. Newton, Chancery Lane—Grain harvesters.—A com.
1691. Edward Conroy, Boston, U.S.—Cutting corks.

5th June, 1862.

1692. George Rydill, Wardrobe Place—Hydraulic pump.
1693. J. E. Moironx, Windmill Street—Protecting surfaces of metals, woods, &c.
1694. James Bell, Portobello—Fastening railway chairs.
1695. Robert Robinson, Hull—Fire-escapes.
1696. J. M. and J. Stanley, Sheffield—Stoves.
1697. John Heatley and James Tangye, Birmingham—Lifting jacks.
1698. Richard Sill, Birmingham—Attaching cards or plates.
1699. P. M. Parsons, Blackheath—Ordnance.
1700. William Rowe, East India Road—Forge and bellows.
1701. Edward Conroy, Boston, U.S.—Cutting corks.
1702. George Hadfield, Bootle Village, near Liverpool—Casks or harrels.
1703. W. E. Newton, Chancery Lane—Organs and wind instruments.—A com.

6th June, 1862.

1704. James Verity, Carlton Road—Coating walls.
1705. Ephraim Death, Liecester—Traction engines.
1706. George Darlinson, Coventry—Ribbons.
1707. W. R. Jeune, Campbell Road—Substitute for solid leather.
1708. A. V. Newton, Chancery Lane—Knitting machinery.—A com.

7th June, 1862.

1709. William Harding, Aldersgate Street—Bonnet fronts.
1710. A. J. Adams, Devonport—Fire-arms.
1711. G. D. Hatton, Manchester—Presses.
1712. George Haseltine, Fleet Street—Photographic camera.—A com.
1713. Charles Hook, Bridgewater—Steam engines.

9th June, 1862.

1714. James Lovegrove, Dalston Lane—Inspecting sewers.
1715. W. H. Turner, Blackburn—Carding engines.
1716. Alfred Ford Battersea—Protecting fluids.
1717. Edouard Hottin, Paris—Preventing stuffs from igniting.
1718. John Keeling, Reading—Gas.
1719. J. M. Ryo-Cattean, Paris—Twisting threads.
1720. C. W. Heckethorn, Brixton—Motive power.
1721. Fernando Giachosa, Warwick—Ventilating mines.
1722. A. J. Joyce, Cambridge Terrace—Lighting and heating.
1723. Arthur Knowles, Birstal—Washing wool.

10th June, 1862.

1724. William Smith, Salisbury Street—Photography.—A com.
1725. Thomas Lister, Hipperholme, Halifax—Address cards, &c.
1726. John Kinlock and Thomas Edmeston, Preston—Looms.
1727. J. A. Pols, Old Kent Road—Refining oils.
1728. Nathan Davis, The Cedars, Putney—Propelling.
1729. G. T. Jourdain, Canonbury—Cocoa nut oil.
1730. H. C. Jennings, Great Tower Street—Preparation of skins.
1731. John Alison, Brightlands—Harrows.
1732. J. B. Ingle, King William Street—Reaping machines.—A com.
1733. J. G. Appold, Wilson Street—Regulating discharge of liquids and gases.

11th June, 1862.

1734. James Shand and Samuel Mason, Blackfriars Road—Steam boilers.
1735. William Lennan, Dublin—Safety stirrup.
1736. J. D. Wake, Cornhill—Ships and vessels.
1737. Henry Bland, Luton, Bedford—Sewing machines.
1738. William Holland, Salford—Carding engines.
1739. William Crook, Blackburn—Looms.
1740. D. Crichton, W. Denbavand, and Duncan Crichton, Manchester—Looms.
1741. John Marsh, New Sneinton—Lace.
1742. J. H. Johnson, Middlesex and Glasgow—Cradles.—A com.
1743. B. W. Gerland, Newton-le-Willows—Sulphate of copper.
1744. J. E. Holmes, Trafalgar Square, Chelsea—Cultivating land.—A com.
1745. John Hetherington, Manchester—Lubricating.

12th June, 1862.

1746. John Ingram and W. P. Wood, Bradford—Colouring matters.
1747. Isaac Spight, Glandford Briggs, Lincolnshire—Horse hoes.
1748. Frederick Tolhausen, Paris—Injecting apparatus.—A com.
1749. A. A. Lerenard, Paris—Cement or mastic.
1750. H. S. Firman and W. J. Williams—Cutting straw, &c.—A com.
1751. H. S. Firman and W. J. Williams, Great Suffolk Street—Lamps.—A com.
1752. Antoine Salvaiti, Venice—Inscriptions.—A com.
1753. Benjamin George, Kingsland Road—Portable beds.
1754. Michael Jackson, Curtain Road—Shield for the guns.

13th June, 1862.

1755. William Smith, Briggate, Leeds—Cutting soap.
1756. George Haseltine, Fleet Street—Rails for railways.—A com.
1757. Abram Longbottom, Hammersmith—Artificial stone.
1758. John Wilson, Albert Square—Ships.
1759. J. H. Glew, Howland Street—Sewing machines.
1760. C. A. Tyler, Birmingham—Holder for plates and dishes.
1761. T. W. Fleming, Bayswater—Charges for fire-arms.
1762. John Bermingham, Cork—Vessels of war.
1763. W. E. Newton, Chancery Lane—Fire-arms and bayonets.—A com.
1764. W. E. Newton, Chancery Lane—Bullets.—A com.
1765. Julius Ives, New York, U.S.—Expressing juice.
1766. John Robinson, Rochdale—Sawing wood.

14th June, 1862.

1767. James Lancelott, Birmingham—Ornamental chains.
1768. Thomas Williams, Red Lion Street, and Henry Cox, Lower Street—Churns.
1769. Joseph Sawyer, Noble Street, and George Padgham, Dalston—Furnaces.
1770. J. G. A. Dallot, France—Circular saw.
1771. J. F. Miguel, France—A system of pessary.
1772. J. H. Johnson, Middlesex and Glasgow—Jacquard machines.—A com.
1773. William Bouch, Shildon, Durham—Cranes.
1774. R. A. Brooman, Fleet Street—Coking ovens.—A com.
1775. William Wighton, Edinburgh—Regulating watches.
1776. Robert Hicks, Kensington Park Terrace—Paints and colours.

16th June, 1862.

1777. C. E. Conrtillier, Paris—Saturating apparatus.
1778. F. M. Lanoa, Paris—Surveying instrument.
1779. J. F. Allan, Glasgow—Furnace arrangements.
1780. G. H. Birkbeck, Southampton Buildings—Extracting liquids.—A com.
1781. James Evans, Hyde, Cheshire—Self-acting mules.
1782. W. J. Curtis, Tufnell Park Road—Screw propellers.
1783. Henry Bright, Woodford, Essex—Screening fires in stoves.

17th June, 1862.

1784. J. E. Holmes, Trafalgar Square—Cultivating land.—A com.
1785. S. H. Huntly, Upper Baker Street—Furnaces.
1786. Andrea Crestadoro, Great Ormond Street—Utilizing power.
1787. John Hunt, Birmingham—Bronzing copper.

1788. W. Sinnock, Nicholas Lane, and J. Rowley, Camberwell—Compound fabrics.
1789. A. W. Makinson, Westminster—Engines.
1790. John Nield and T. A. Nield, Dukinfield—Manufacturing pipes and columns.
1791. Archibald Pringle, Gloster Cresceut—Locks.
1792. Mansfield Turner, Wigston, and E. T. Loseby, Wood Street—Small arms.
1793. Samuel Varley, Sleaford—Reaping machines.
1794. William Clark, Chancery Lane—Buttons.—A com.
1795. George Haseltine, Fleet Street—Railroad cars, decks of vessels.—A com.
1796. Joseph Kellow and Henry Short, Delabole—Blasting powder.

18th June, 1862.

1797. James Wheater and John Townend, Bacup—Mules for spinning.
1798. J. H. Johnson, Middlesex and Glasgow—Projectiles.—A com.
1799. Joseph Warren, Maldon—Ploughs.
1800. Francis Coltman, Normanton—Discharging coals.
1801. W. E. Newton, Chaucery Lane—Electrical brushes.—A com.

19th June, 1862.

1802. William Clark, Quadrant Road—Manufacture of boxes.
1803. J. L. Smith, St. John's Square—Fire alarum.
1804. George Speight, Saint John Street Road—Head ornaments.
1805. Andrew Howat, Farnworth—Water gauges and taps.
1806. Henry Rushton, Northampton Road—Plaiting machines.
1807. William Stokes, C. W. James, and John Stokes, Birmingham—Guns.
1808. Richard Stansfield and John Dodgeon, Todmorden—Looms.
1809. Charles Cartwright, Liverpool Street—Retarding trains.
1810. Montague Wigzell, Topsham, Devon—Bolts for shipbuilding.
1811. E. J. Davis, West Smithfield—Preparing food for animals.
1812. J. B. Wood, Broughton—Driving bands, wire cards, and cop tubes.
1813. William Thomson, Thorney—Bricks and tiles.

20th June, 1862.

1814. William Jeffries, West Bromwich—Rail for railways.
1815. J. G. Dupuch, Paris—Gas cocks.
1816. J. B. T. Detuncq, Somme, France—Treating flax or hemp.
1817. W. E. Gedge, Wellington Street—Candlesticks.—A com.
1818. John Bedford, Paris—Plane iron, cut iron, &c.—A com.
1819. William Malins, Pershore—Protective covering for agricultural purposes.
1820. D. Adamson, Newton Moor, and Levi Leigh, Saint Petersburg—Steam boilers.
1821. B. M Mody, Trafalgar Square—Varnish or polish.
1822. J. W. Taylor, Newsome—Valves.
1823. David Middleton, Burton-by-Lincoln—Cranes.
1824. Charles Osman, Chryssell Road, Brixton—Elastic surfaces for sitting upon.
1825. Arthur Warner, Threadneedle Street—Pigments or paints.
1826. George Gray and David Cunningham, Whitebum—Moulding metals.

21st June, 1862.

1827. Bernardo Fabbricotti, Leadenhall Street—Grinding belt.—A com.
1828. F. E. Schneider and Jacob Snider, Walpole Street—Fire-arms.
1829. G. W. Yapp, Old Brompton Road—Colours and tints on glass.—A com.
1830. James Taylor, Oldham—Doffer or stripper.
1831. George Simpson, Glasgow—Mining tools and pumps.
1832. H. D. and J. Daveuport, Bradford—Loom healds or harness.
1833. John Anderton, Accrington—Sizing machine.
1834. Stephen Holman, Canon Street—Pumps and valves.
1835. Henry Gonuou, France—Bricks.
1836. A. F. Maigrou, France—Carding and spinning.
1837. J. H. Redstone, New Oxford Street—Boilers.
1838. Frederick Tolhausen, Paris—Collisions on railways.—A com.
1839. G. T. Bousfield, Brixtou—Valves.—A com.
1840. John Lawson, Glasgow—Carpets.
1841. Ezekiel Edmonds, Berryfield, Wiltshire—Felted articles.—A com.

23d June, 1862.

1842. Thomas Wilson, Birmingham—Dress fastening.
1843. Hugh M'Kenzie and Patrick Ramsay, Glasgow—Brushes.
1844. Henry Ponsonby, Liverpool—Top sail bits.
1845. George Haseltine, Fleet Street—Reaping machines.—A com.
1846. Alexander Webster, Arbroath—Boring slate.
1847. William Barr, Coventry—Brocaded fabrics.
1848. Richard Cook, Finsbury Place South—Pianofortes.

24th June, 1862.

1849. Abraham Ripley, Brook Street—Damper governors.
1850. William Hargreaves and G. H. Leather, Bradford—Combing.
1851. Thomas Carr, New Ferry, Cheshire—Grinding, washing, &c.
1852. Theophile Desgrandschamps, Paris—Steam engines.
1853. George Collier, Halifax, and J. W. Crossley, Brighouse—Hot pressing.
1854. William Bayliss, Wolverhampton—Wire feucing.
1855. James Johnston, Paisley—Hats.
1856. George Gray, Greenwich—Wheels.
1857. E. C. Nicholson, Locksfield—Colouring matters.
1858. William Clark, Chancery Lane—Orthopedic apparatus.—A com.

25th June, 1862.

1859. M. A. F. Mennons, Paris—Furnaces.—A com.
1860. Samuel Brooks, Manchester, and Samuel Deuton, Oldham—Spinning.
1861. John Blair, Manchester—Wadding.
1862. William Clark, Chancery Lane—Ploughs.—A com.
1863. George Haseltine, Fleet Street—Lamps.—A com.
1864. Frederick Tolhausen, Paris—Locks.—A com.
1865. Abraham Bayley, Liverpool—Lamps.
1866. C. C. Steenstrut, Horten, Norway—Lubricating can.
1867. E. H. Huch, Brunswick, and F. J. Windhausen, Duderstadt—Engines.
1868. John Whitham, Leeds—Hydraulic presses.
1869. George Turner, Brompton—Mincing and grinding.
1870. Justin David, Paris—Dynamometer.
1871. William Clark, Chancery Lane—Photographic picture frames.—A com.
1872. William Clark, Chancery Lane—Raising the nap on fabrics.—A com.

26th June, 1862.

1873. E. T. Hughes, Chancery Lane—Pianofortes.—A com.
1874. George Peterson, Brompton Square—Distillation.—A com.
1875. T. R. Tebbutt, Manchester—Soap and soda.
1876. John Parkes, London Street—Gas lanterns.
1877. J. B. Coquatrix, Paris—Weaving carpets.
1878. Jules Martin, France—Mowing machines.
1879. J. H. Johnson, Middlesex and Glasgow—Electro voltaic plate work.—A com.
1880. J. H. Johnson, Middlesex and Glasgow—Fluids for illuminating—A com.

27th June, 1862.

1881. Alexander Anderson, Islington—Steering vessels.
1882. John Watson, Old Bailey—Printing.
1883. Charles Cochrane, Middlesbro'-on-Tees—Aluminate of soda.
1884. Edward Hunt and H. D. Pochin, Salford—Condensing apparatus.
1885. Charles Cochrane, Middlesbro' on-Tees—Manufacture of iron.
1886. Josiah Lord, Todmorden, and John Brown, Burnley—Power looms.
1887. William Owen, Coventry—Woven tickets of silk or wool.
1888. R. A. Brooman, Fleet Street—Transferring photographic pictures.—A com.
1889. A. H. Martin. Bradford—Weaving.
1890. Isaac Holden, Bradford—Combing wool.
1891. A. A. Croll, Coleman Street—Ammoniacal liquor.
1892. D. L. Banks, Gracechurch Street—Coffer dam.
1893. D. L. Banks, Gracechurch Street—Dry docks.

28th June, 1862.

1894. M. A. F. Mennons, Paris—Swellings in the limbs of horses.—A com.
1895. Thomas King, Grafton, and John King, Chadshunt—Agricultural machines.
1896. Charles Beslay, Paris—Galvanizing metals.
1897. G. H. Hulskamp, Chancery Lane—Pianofortes.
1898. John Garnier, Devonport—Ordnance and projectiles.
1899. G. W. Belding, King Street—Flexible fabric.
1900. Charles Callehant, Paris—Sewing machines.
1901. John Tatham, Rochdale—Spinning and doubling.
1902. James Petrie, Rochdale—Slide valves.
1903. John Webster, Ipswich—Incrustation of boilers.
1904. Nathan Thompson, Abbey Gardens—Stopping bottles.

30th June, 1862.

1905. Joseph Wall and Thomas Dodd, Liverpool—Taps.
1906. William Thomas, Liverpool—Carriages.
1907. James Hartshorn, Nottingham—Lace.
1908. Aungeir Byrnes, Metropolitan Buildings—Fire arms.
1909. W. E. Gedge, Wellington Street—Looms.—A com.
1910. W. F. Murray, Glasgow—Stoneware bottles.
1911. W. E. Newton, Chancery Lane—Picking cotton.—A com.
1912. William Easton and George Donkin, Gateshead-on-Tyne—Annealing glass.
1913. Thomas Parker, Leeds—Dyeing fabrics.

1st July, 1862.

1914. John Parkinson, Bury, and John Marsland, Newchurch—Regulating fluids.
1915. E. F. Prentiss, Birkenhead—Omnibuses.
1916. Edmond Pourpoint, Paris—Wool washing machine.
1917. R. A. Brooman, Fleet Street—Blast furnaces.—A com.
1918. Charles Lungley, Deptford—Floating docks.
1919. G. H. Birkbeck, Chancery Lane—Treatment of mineral substances.—A com.
1920. Jesse Greenhalgh, Hyde, and James Greenhalgh, Audenshaw—Valves.
1921. Thomas Fellowes and Henry Hemfrey, Spalding—Elevating straw.
1922. J. M. Dunlop, Manchester—Cotton gins.
1923. W. E. Newton, Chancery Lane—Washing wool.—A com.

2d July, 1862.

1924. E. De Lebastida, Hart Street—India-rubber articles.—A com.
1925. William Porter, Fleetwood—Targets.
1926. John James, Newport—Welding railway crossings.
1927. Joseph Ellerbeck, Heywood—Looms for weaving.
1928. Bryan Johnson, Chester—Rope wheels for mines.
1929. T. L. Atkinson, Stamford Street—Stew pans.
1930. G. H. Hulskamp, Chancery Lane—Violins and guitars.
1931. John Murray, Whitehall Place—Portmanteaus.
1932. John Steel, Stirling—Water closets.
1933. Joseph Crisp and J. W. Elliott, South Shields—Burning oils.
1934. James Webster, Birmingham—Gas.
1935. George Bedson, Manchester—Rolling wire.
1936. J. M. Hetherington, Manchester, and Thomas Jackson, Stockport—Spinning.

3d July, 1862.

1937. Thos. Turner, Birmingham, and W. Taylor, Asbton New Town—Fire arms.
1938. G. H. Birkbeck, Chancery Lane—Mechanical horses.—A com.
1939. W. A. Gilbee, South Street—Blue colouring matter.—A com.
1940. W. M. Williams, Handsworth—Hydro-carbons.
1941. Thomas Edmunds, Seymour Place—Fruit cakes.
1942. T. O. Dixon, Steeton—Heating buildings.
1943. James Miles, Glastonbury—Boots and shoes.

4th July, 1862.

1944. Samuel Russell, Shaftesbury Crescent, Pimlico—Stereoscopes.
1945. W. J. Cunningham, Victoria Dock Road—Sewing machines.
1946. Adolphe Drevelle, Manchester—Folding or stretching fabrics.
1947. Samuel Whitham, Wakefield—Iron and steel.—A com.
1948. John Howard and John Bullough, Accrington—Beaming machines.

5th July, 1862.

1949. Henry Rushton, Northampton Road—Covering crinoline steels.
1950. R. A. Broomau, Fleet Street—Plates for hydraulic presses.—A com.
1951. O. F. Bystrom, Stockholm—Pyrometers.
1952. C. G. Hill and William Jackson, Nottingham—Lace patterns.
1953. Arthur Warner, Threadneedle Street—Purifying coal gas.
1954. P. B. O'Neill, Warwick Street—Screw wrenches.

7th July, 1862.

1955. Joshua Kidd, Cannon Row—Gas meters.
1956. Charles Wessely, Canterbury Place—Carriages.
1957. Thomas Edwards, Liverpool—Indices for meters.
1958. James M'Geary, Bayham Terrace—Gas.
1959. J. P. Booth, Cork—Feather beds, bolsters, and pillows.

8th July, 1862.

1960. William Spence, Chancery Lane—Telegraphic apparatus.—A com.
1961. J. H. Johnson, Middlesex and Glasgow—Wet gas meters.—A com.
1962. C. E. Gruner, Alfred Street, Islington—Photographic apparatus.
1963. John Brown, Middleton—Doffers of carding engines.
1964. Joseph Russell, Manchester—Time tables.
1965. Charles Slatford, Cannon Street West—Trimmings.

TO CORRESPONDENTS.

J. G.—Paddles have been applied transversely for turning and handling ships in various ways. We do not think there is anything new in your proposition. There is at least one vessel on the Clyde, at the present moment, using a contrivance of this kind. There are grave objections to the use of either paddles or screws in the positions mentioned.

PROGRESS OF THE EXHIBITION.

ART. IV.

The mistakes, the vulgarities, the breaches of faith with portions of the public upon the part of the Commissioners of the Exhibition, the complaints of which reach the ear and eye everywhere—but to all of which, these official pachyderms appear no more sensible than a turtle is to being patted on the back—are all traceable to a single cause, namely, the determination of the Commissioners, from the outset, to turn the Exhibition to an unavowed and illegitimate end.

Professedly the direct aim and primary object of this, as of every other Exhibition of the sort, is a stock-taking of human progress within a given epoch, and such an exposition of the means by which, and the results to which, that progress has attained, as may, in the largest sense, increase the knowledge, improve the tastes, enlarge the faculties and the material means—in a word, shall *educate* all, more or less, who come within its reach; pleasure is, in such a case, a mere adjunct—money-making not even that. But this is not all, the stock-taking is most imperfect, that does not also make itself felt as the periodic exponent, in a manner the most decisive, lucid, and scientific possible, of every new product or natural material; of every power in nature, produced in concrete, at this inswept gathering from the whole earth. Nor even yet is this all—for the Exhibition, in the person of its Commissioners and through its Jurors, professes to exercise judicial functions. It has held its court, in which those appellant or arraigned, have often, it is true, been most imperfectly represented, or been kept out of court altogether; and it has made its awards—*judgments* in reality of *censure* and of *praise*, both—for it is idle to say, that in the bestowal of rewards only, censure is not negatively inferred, to those who receive them not. We are not now quarrelling with the awards (although, we believe, there is quite ground for doing so), we are simply pointing out the gravity of the legitimate aims and duties of those entrusted, by the civilized world, with the conduct of this Exhibition. To carry these aims through, in all integrity, with all fulness, was, and is, the *first duty* of these Commissioners. *Next* to that, but only *second* to it, stands their duty, as far as was consistent with the first, to make the Exhibition self-supporting in a pecuniary sense; to see to it, by all just means, that the guarantors should, *if possible*, not be called upon, to make good a deficiency. Should, after all expenses were paid, a surplus arise, as in 1851, well and good; it would be the suitable and satisfactory reward and conclusion, of good stewardship, and, perhaps, in part, of good fortune; and *when* it was found to have resulted, if ever, *but not before*, would it be legitimate and proper, that the Commissioners, calling others to their council, as simple trustees of money not their own—not even owned by England alone—and over which they, in any circumstances, could have no inherent right of control, should then consider and decide to what uses any such surplus might be applied.

Not with such views, nor thus, however, have the Commissioners acted. Mindful of their power and permanence—those of a quasi-corporation, with much of corporate power and nothing of corporate responsibility—which they were most unwisely permitted by the public and by Parliament to acquire, by the mode of investment, &c., of the surplus of 1851, the Commissioners of 1862 started from the post, with a double aim—to the second of which, namely, the procuring a surplus *or a profit upon the Exhibition*, to be used for ulterior and unavowed, but to themselves and their creatures clearly shadowed forth, objects, the immediate and legitimate aims and intents of the intended exhibitors were really held subordinate. "Put money in thy purse," honestly if thou may'st, but "put money in thy purse," was the view, perhaps inarticulate, but nevertheless the view, from the beginning, of these functionaries; foreign from whose duty and business it was, even so much as to have contemplated the making of any profit, and whose foregone conclusions as to what they would do with a profit, which they had no right to anticipate, but resolved they would make—was in reality, by anticipation, an ignoble breach of faith, to the high duties committed to them by the civilized world. "If thine eye be single, thy whole body shall be full of light; but if thy light be darkness, how great is that darkness," has since, in every step they have taken, found its realization and uttered its warning; but in vain to them—for the first grand false step, had committed them to all the rest. "The past is past," so far as remedy is concerned, for much of what has since resulted, though we trust it is not past for public reprehension, when the Exhibition shall have closed, and Parliament shall have again met; nor for the fitting and obviously called-for moral to it all—that not a brick of the monstrous pile, heaped up with these ulterior views, shall be permitted to remain standing, an eye-sore and disgrace to London, and a permanent *punctum stans* for future jobbing, on the part of its devisers.

We are not going therefore, now, to point out in detail the evils that *have happened*, but, while yet there may be perhaps time and other means, and possible measures for their redress, to point out some of those that are happening, and must arise, during the remaining time that the Exhibition (now beyond its meridian) remains open.

We propose to point out, in short, some of the measures that properly belong to every Exhibition of this kind—that are indispensable to rightly and fully husbanding its results, but which have been so far, and most probably will be to the end, ignored and neglected by the Commissioners, because their own duplicity of aim has brought them into the predicament, of now dreading a deficit, in place of a contemplated surplus. We propose to show one or two of the directly legitimate purposes to which some portion of the funds of every grand Industrial Exhibition (whether surplus or otherwise) ought to be applied.

Here, then, are gathered countless "raw products," as they are rather unhappily called, rocks, building stones, marbles, cements, ores, fuel, timbers, precious woods, oils, strange drugs, fibres, vegetable materials for paper, and countless other uses; some are seen for the first time—numbers have never yet been examined by the hand and eye of science. Are all these to be bundled out of the building, after those few months of feverish crowding and excitement, during which no competent man has had time, or opportunity, or means, for eliciting their hidden natural powers, and be got rid of when and how they may?

In 1851, although some attempt was made to conserve in perpetuity, some fragments of the vast collection of raw products, no well-considered plan was adopted, nor any, until too late. We believe we are not misinformed that in the end, cart-loads of ores, minerals, and like specimens, were drawn away and shot as rubbish, from that gathering. Is no attempt to be made now, to collate, by competent men, the whole mass, and to garner from it, in some fitting place of permanent occupation, all that is worthy of future and mature examination. If not, then, except for the purpose of *the show*, almost as well might these hundreds of tons of varied materials never have been unpacked. Who that is capable of being made wise by them, has been so by passing them by, in the mob of the Exhibition? What new trades, what new sources of industry and wealth, hidden in these sticks and stones, shall otherwise result? A permanent Collection is what is needed—one great technical one, embracing everything mineral, at Jermyn Street; another embracing everything vegetable, at Kew; a third containing all that is animal, at Regent's Park. No more suitable use could have been made of any surplus funds than in the purchase of such objects for such collections. But this would be for the close—for "the time to scatter and to gather;" but meanwhile, and while all remains intact, is no attempt to be made by science, to fix the attention of the busy and restless worlds of industry and of capital, upon the *properties* of the treasures they vaguely wander amidst?

One firm alone has exhibited between four and five hundred specimens of precious woods; there are thousands of others (in fact never before so great, so perfect a collection) from our own colonies and other parts of the world. Of these we shall be safe to say that not one timber in six, capable of useful adaptations, has ever been subjected to the scrutiny of science at all, and that of a still smaller fraction are the constructional constants known, or complete. In 1855, at Paris, some experiments were made by English Commissioners on the physical properties of a few of the

timbers exhibited; and the report, incomplete even as it is, is a valuable accession to our knowledge. Enough was done to show the desirability of having now a complete experimental examination of those newly produced timbers and woods. Physical, with a view to construction, useful or ornamental, as respects nearly all of them; chemical and technical, as respects many, with a view to, potash making, dyeing, pharmacy, and so forth. One wood only, *Greenheart*, has as yet the reputation amongst engineers, of resisting the attacks of the Teredo and other marine xylophagi. Is there no other timber with like properties in the forests of the world?

From the Dutch colony of Java has come numerous cakes of "Half Stuff," for making paper from—stowed away in an obscure glass case, where few have ever even discovered them—yet almost all, of new and remarkable vegetable materials. Is no attempt to be made to submit these to the technical and scientific scrutiny of our paper makers, and ask from them a report of the result. Are the strange and unknown, and probably in some cases at least, new drugs, chiefly vegetable, brought with such care from Japan, to be practically lost to European medicine? They will be so, if in place of being *examined now*, and while intact—by competent men asked to experiment and report upon them—they be huddled away, divided, lost, as was so much of like character and interest, from the Indian and other collections in 1851. Here are fuels from the ends of the earth—here is Albertite coal from New Brunswick, with the fracture and almost with the hardness of obsidian, yet apparently almost pure bitumen; coal from New South Wales, coal from Nelson—are their properties known and published—are we to be satisfied with having looked at them?

We might, without exhausting the subject, enlarge such illustrations of the importance of devoting a liberal portion of the funds, of this and of every such Exhibition, to the appointment of several competent persons, paid for their services, and responsible by reputation as well as by contract, for the results they render—who should, while the collection is still untouched, thus quintessentialize and lay up in store for the world's future use, all that is most valuable within it, in the shape of ascertained knowledge. But so far from any attempt being made in this direction, the Commissioners actually ignore the precedent of the publication of the jury reports—the only likeness to any authentic and permanent record, officially resulting, from former Exhibitions—and hand over this task to the Society of Arts, in a way that can only result in an imperfect and irresponsible set of documents, having little but bulk of paper and print to recommend them. Even the able and zealous editorship of Dr Playfair cannot ensure any other result under the conditions in which he will be placed; and thus to parsimony incompatible with duty, will be sacrificed even means hitherto attempted for gathering and hiving the rich knowledge of the world's treasures, and the Exhibition be permitted to depart like the baseless fabric of a vision, leaving not a wreck behind. We have, however, exhausted our space for the present month, and must reserve some remarks as to the jury awards and reports to a future month—the rather since up to this date, (August 7), the jurors generally have been kept without receiving the copies promised them of the printed awards, although several weeks have elapsed since they were first published, and the Commissioners have been able to provide any number to those who would pay five shillings a copy for them.—Ed.

Note.—We regret much a typographical error which crept into our leading article last month. In page 113, column 2, line 34 from top, for "Cuviers," read Ouvriers.

REGENERATIVE GAS ENGINE.

By W. C. William Siemens, C.E., F.R.S.—*Illustrated by plate* 290.

The problem of obtaining from heat a larger yield of power than can be realised by the steam engine, has occupied the serious attention of Mr Siemens for a number of years. The regenerative steam engine, constructed by him in 1847, combined two important features, the regenerative and superheated steam, in such a manner, that the steam produced in a boiler was made to exert its elastic force upon the working piston several times by being alternately superheated and brought back to the point of saturation. The regenerative has since been applied very successfully by Mr Siemens and his brother Fred. Siemens, to furnaces; and the second feature in the regenerative steam engine, that of superheating the steam has, as our readers know, been also applied successfully of late to the ordinary steam engine, with very beneficial results. Yet the regenerative steam engine did not succeed in practice, owing, we understand, to the difficulty experienced in superheating the steam to the requisite high degree of 800° Fah. without rapidly destroying the vessel employed for that purpose. The failure of the several hot air engines which have been proposed, may, we think, be closely traced to the same cause.

In Mr Siemens' present engine this great source of difficulty has been removed, by the expedient of burning the gaseous fuel employed, under pressure, within the heated vessel where the elastic force to move the piston is generated. Fig. 1, plate 290, represents a vertical section of the engine, fig. 2 is a plan of the same, and fig. 3 is an end view partially in section. The action of the engine is briefly as follows. The two working pistons are attached by means of connecting rods to two cranks upon the working shaft standing 180° apart. The cylinders are surrounded by water, to keep them cool, but a hollow extension of each working piston, protected at the end by plumbago or other refractory material, extends upwards into a cylindrical chamber of cast iron, lined also with refractory material, without touching the sides of the same. Here the combustible gases are introduced at the commencement of each downstroke, through an ordinary slide valve, and are regenerated; upon entering the lined chamber they are ignited, filling the same with the hot products of combustion. A certain amount of water being introduced with the gases, superheated steam is also formed in the regenerator to swell the volume. The slide valve being shut before the piston has completed one-third part of its stroke, considerable expansive action is obtained, by which the stroke is completed; the expanded gases are allowed to escape through the regenerator and the slide valve into the atmosphere. The heat still contained in the gases after expansion has taken place is retained in the regenerator to be communicated to the fresh gases and vapour at the commencement of the succeeding stroke. The ignition of the gases is effected upon their entering the combustion chamber by means of a small cavity in the refractory lining, which is heated to a high temperature, previous to starting the engine, by the combustion within the same of combustible gases, introduced through a very contracted aperture.

The gas employed in working this engine, is produced by the destructive distillation of fuel in an apparatus of the nature of Mr Siemens' gas generator for working his furnaces. It is compressed, together, with the air necessary for its combustion, by means of a pump into a small reservoir, when it passes through a pipe into the slide valve box of the engine. A small stream of water is allowed to pass with the air into the pump, and take up the heat generated in compression, forming steam. The power of this engine is due to the great increase of volume of the gases and vapours employed in being heated to the point of ignition. No boiler or chimney is required, the gaseous fuel is taken up by the engine, and the products of combustion are discharged from it in a cooled condition, the heat generated being almost entirely converted into force. Mr Siemens has exhibited a model engine of this description at the Exhibition, (Class 8, working area), and has been awarded a medal for the same. We understand that a larger engine has lately been built, which is about to be put to work in London. We hope shortly to be able to state particulars of the results that will be obtained.

ON BOILER DEPOSITS AND INCRUSTATIONS.*

In presenting to the Institution of Civil Engineers of Ireland the following translation of M. Couste's Memoir on Boiler Deposits, by Mr Robert Trefusis Mallet, now employed as a resident engineer upon the Great East Indian Railway, Bengal, it may be desirable to preface it by a brief statement of the principal conditions that affect questions, of the nature, formation, or prevention of boiler deposits.

The importance of the subject to mechanical engineering, and to the public, cannot be overrated. The efficient exclusion of deposits and incrustations from innumerable land boilers of Great Britain alone, would involve the economization of millions of tons of fuel,—the preservation of many lives periodically destroyed by explosion, often traceable to this as one in the train of causes; while if perfected in marine boilers, it would revolutionize much of our steam ship machinery. That such possible results are recognized, is proved by the fact that more than seventy patents encumber the records at this moment, for methods presumed to mitigate or to prevent deposit or incrustation of boilers; yet amongst these it may be affirmed, that there is not even one that fully answers its purpose, while the great mass consist of mere "nostrums," that only prove the general ignorance of the conditions in the problem by the inventors and by the public. I do not, therefore, suppose that any apology is required from me on the part of the translator of M. Couste's most valuable memoir, although its first appearance in its original language dates some years back; for I am myself aware that, owing probably to its having been inaccessible except in a foreign tongue, it has remained up to the present time almost completely unknown to British mechanical engineers. Yet it contains a rigorous

* From a Memoir about being published in the Transactions of the Institution of Civil Engineers of Ireland.

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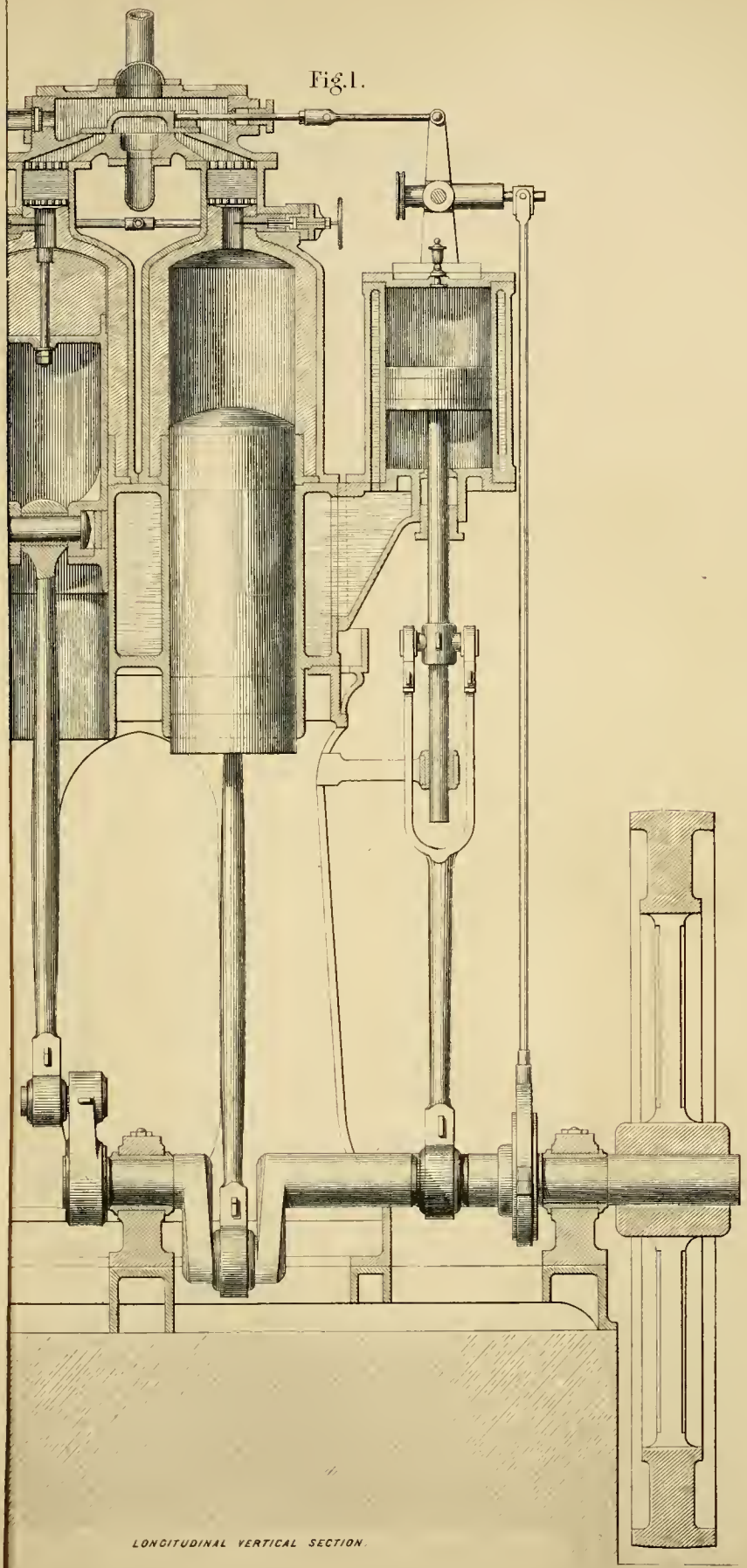
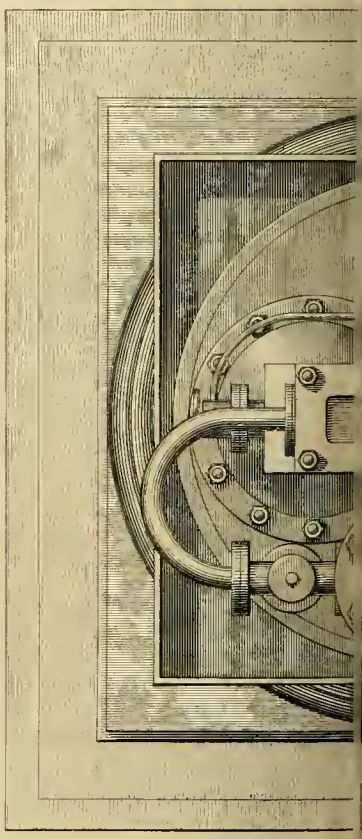
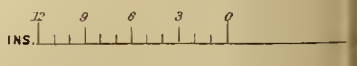
Fig.1.



LONGITUDINAL VERTICAL SECTION.





IVE GAS ENGINE,

C.W.& F. SIEMENS.

'S. GREAT GEORGE ST.

ESTMINSTER.

Fig.2.

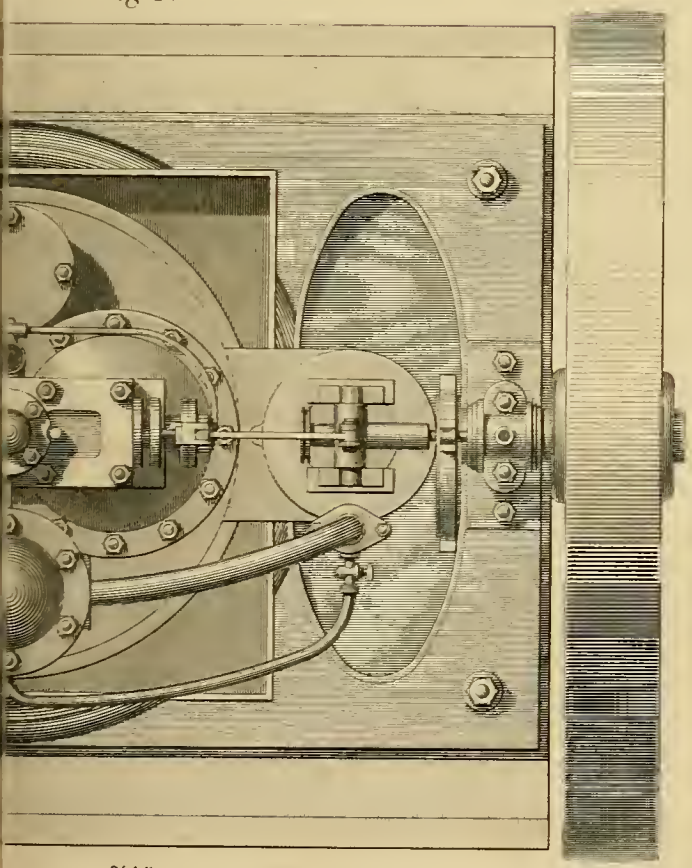


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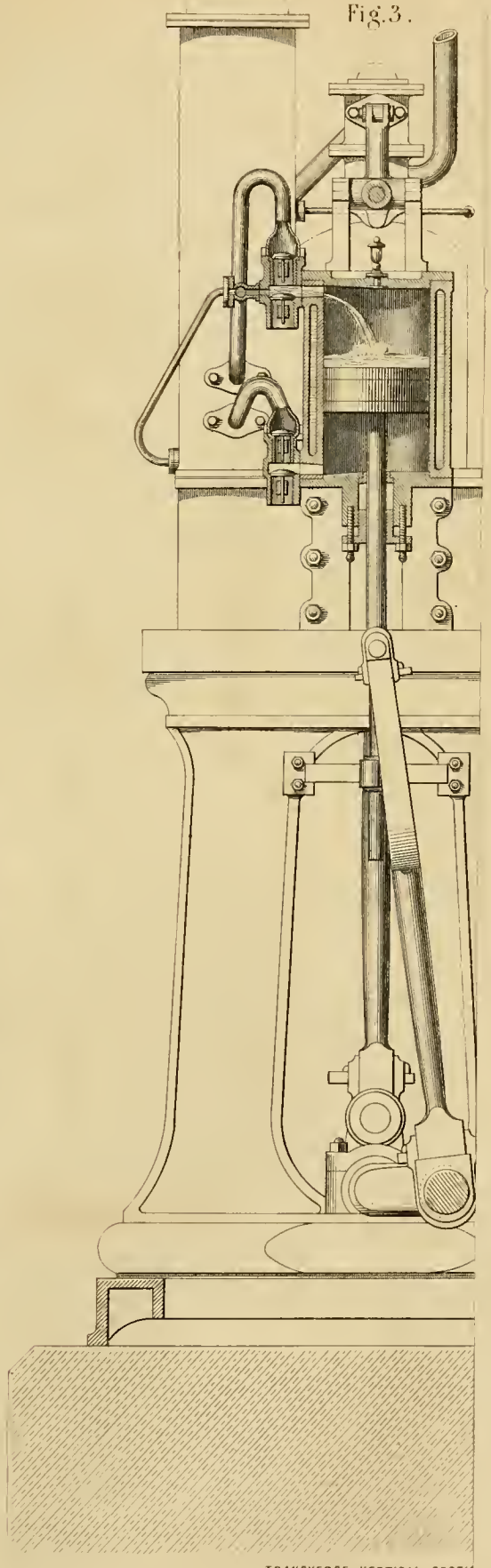
Fig.3.



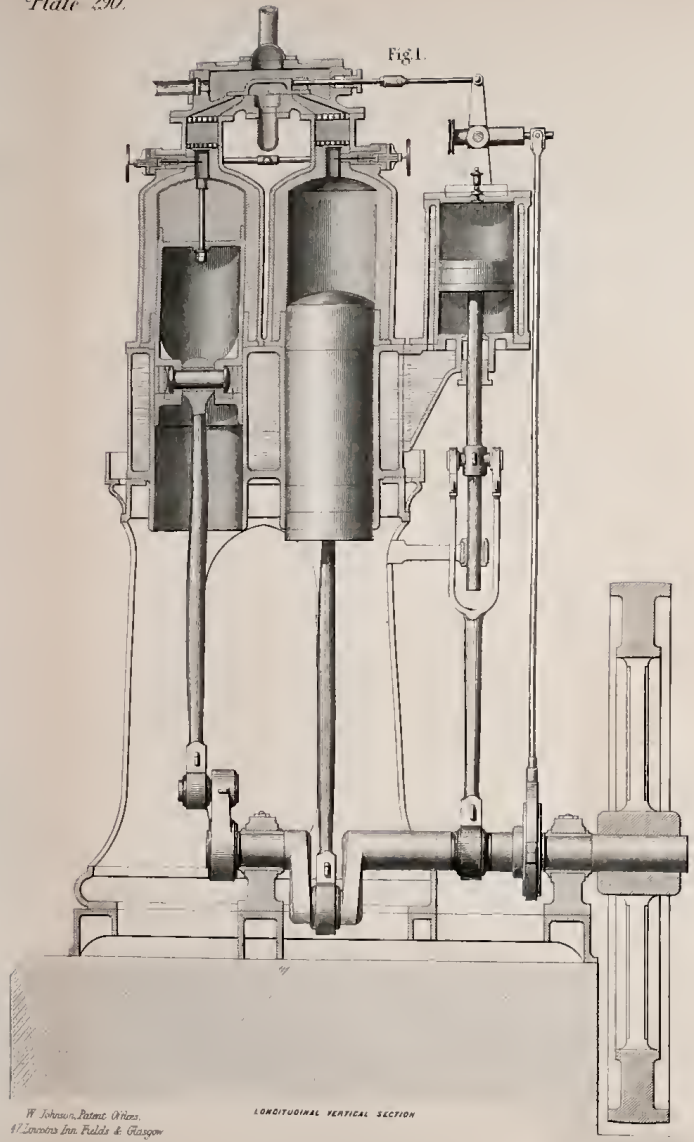
TRANSVERSE VERTICAL SECTIO

Plate 290.

REGENERATIVE GAS ENGINE.

MESSRS C.W. & F. SIEMENS.
ENGINEERS, GREAT GEORGE ST
WESTMINSTER.

Fig. 1.



LONGITUDINAL VERTICAL SECTION

Fig. 2.

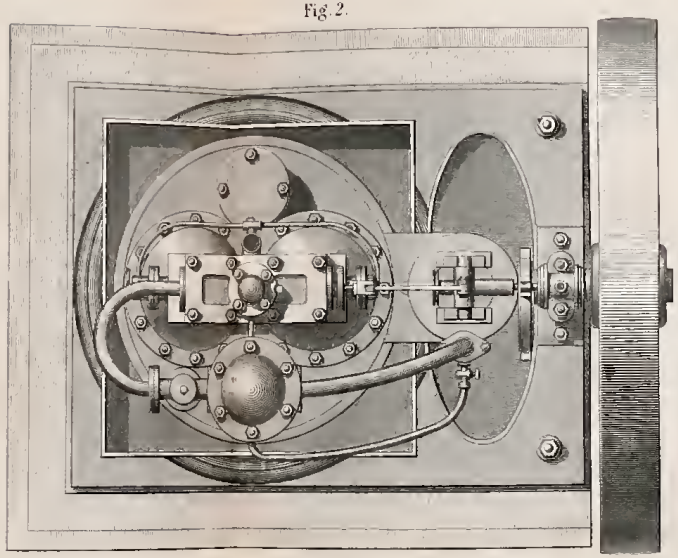


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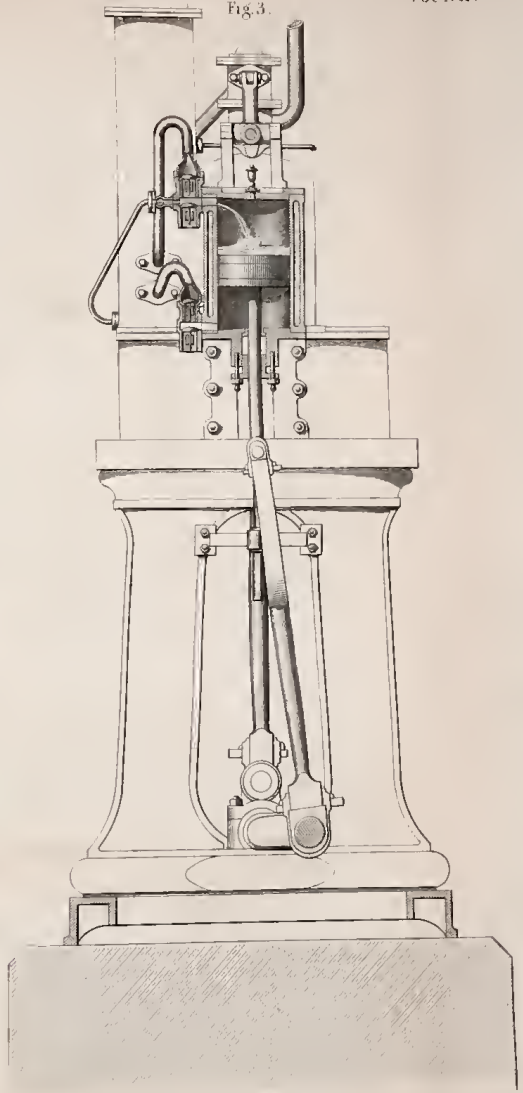
Fig. 3.



TRANSVERSE VERTICAL SECTION

W. Johnson, Patent Offices,
47 Lincoln's Inn Fields & Glasgow
Mackay & Chalwood Lith.

investigation of some of the most important conditions upon which depend the *only* method so far effective for the prevention of boiler deposits namely,—the continuous removal of determiuate volumes of the heated fluid, so as to avoid saturation and depositiou, whether partial or total.

M. Couste touches but slightly upon the chemical or miueralogical parts of the subject; he deals principally with its thermic and dynamic relations.

I propose, therefore, to preface the translation of his memoir, by passing the former very briefly in review, and referring as briefly to some of the modes, patent, or otherwise proposed as remedies, and chiefly dependent on chemical relations.

Exclusive of "mine waters," or other natural waters, mineralized or polluted, and hence everywhere to be shunned for feeding boilers, and therefore rather beside our subject, the natural waters with which steam boilers are supplied for evaporation may be divided into—1st, Fresh water,—2d, Sea water; and the questions for the practical engineer refer to the uature of tbeir solid contents, the causes and order of deposit of these, and to the action of their solid contents upon the boiler.

The primary effects of the solid contents of the water ceasing to remain in solution as when introduced to the boiler are, 1st, Deposition, and at a further and more or less prolonged stage, Incrustation; i.e., the induration of the previously unintegrated precipitate, whether amorphous or finely crystalline.

And the immediate consequences are—

1. Interference with the full functions of the boiler in supplying steam.
2. The promotion of its destructive action hy the fire and flame of the fuel upon its shell.

While the remoter consequence is the danger of explosion induced, which becomes extreme when the deposit is thick and diffused.

The destructive reaction upon the boiler again is two-fold.—

1. Mechanical.—The deposit or incrustation preventing the free passage of heat to the water through the shell of the boiler, causing waste of fuel and overheating of the boiler, and interfering (in various constructions of boiler) with the free circulation of the fluid, upon which the rapid taking up of heat by it so much depends.

To treat fully of the last would involve the passing in review a great number of different forms and constructions of boiler, and be quite beyond our scope here.

It is enough to say, that obviously boilers, with intricate interior construction, closely placed tubes and water spaces, &c., will be most liable, *cæteris paribus*, to this injurious result.

2. Chemical.—Corrosion and destruction of the metal of the boiler due to the action of more concentrated saline matter, soluble and insoluble; and to that of the air and gases of the furnace acting on the metal brought to a higher temperature.

Both effects under this head are modified by the nature of the metal of which the boiler is constructed; and practically, our steam boilers may be classed as either of iron, or of copper, or of some few of the alloys of the latter.

Boilers of iron are most acted on by air and water, and by some of the saline contents of fresh and sea water when concentrated; while copper boilers (once strongly advocated for marine purposes) are more affected by the oxidized sulphur of the coal, and by the ammonia evolved from its combustion, and by the oily acids of the grease pumped into and spread about the boiler. It should be remarked in passing, however, that when sulphurous fuel is burnt at an intensely high temperature in direct contact with the boiler shell, iron is acted on with great rapidity (whether with or without internal deposits), and apparently by the direct formation, at the external surface of the iron shell, of successive thin coats of bi-sulphuret of iron; hence it is, as one cause, that copper fire boxes possess their durability in locomotive fire boxes. There are other and independent reasons for this durability, however.

In the class of natural fresh waters, the substances *most commonly* found dissolved are lime, soda, iron, magnesia, potass, alumina, and silica, (the relative quantities being *usually* in the order here set down) and in combination with oxygen, chlorine, occasionally with oxidized nitrogen, in the form of nitrates and carbonic acid.

Organic compounds of carbon, hydrogen, and nitrogen, are also often present. Besides these, natural fresh waters contain air in solution, often with excess of oxygen, carbonic acid, uncombined with solid bases, and more rarely sulphurreted hydrogen.

The analysis of Thames water by Dr R. D. Thompson, as supplied by some of the London Water Companies, may be taken as a type of our common hard waters, receptive (more or less) of putrescible matter—and hence of such as most commonly supply our land steam boilers.

In this city (Dublin) the well waters from the limestone gravel are much more rich in sulphate of lime, which is still more the case in the waters, for example, of the Paris Gypseous Basin. Hence, in so far, the latter are both worse than the London water as steam boiler supply—sulphate of lime forming, in fact, both in land and marine boilers, the most insoluble and intractable portion of any deposit formed.

The solid matters contained in one imperial gallon of Thames water, according to the above chemist, are:—

Thames Water.

Chloride of Sodium, ...	16.00 grains.
Sulphate of Potass, ...	2.41
Chloride of Maguesium, ...	2.10
Carbonate of Magnesia, ...	0.50
Chloride of Calcium, ...	2.11
Nitrate of Lime, ...	0.07
Sulphate of Lime, ...	3.18
Carbouate of Lime, ...	10.70
Oxide of Iron and Alumina, ...	0.46
Silica, ...	0.24
Organic Matter, ...	3.56
Total, ...	41.33 grains.

A boiler fed with such water (and this is not a remarkably impure one). a locomotive, for example, blowing off into steam 1000 gallons per hour, would, at the end of 350 hours, if no deposit or solid matter were blown out or otherwise removed, contain nearly a ton of sediment.

An imperial gallon of water is capable of holding dissolved when cold, (60° Fah.,) and when boiling in free air, (212° Fah.,) the following weights nearly, of the more important of the preceding salts:—

	At 60° Fah.	At 212° Fah.
Carbonate of Lime, - -	merely traces	merely traces
Silica, - - - -	70 grains	"
Sulphate of Lime, - -	170 grains	"
Carbonate of Magnesia, -	3.25 oz.	"
Sulphate of Potass, - -	10 oz.	40 oz.
Chloride of Sodium, - -	32 oz.	32 oz.
Chloride of Magnesium, -	266 oz.	580 oz.
Nitrate of Lime, - -	500 oz.	" ?
Chloride of Calcium, - -	540 oz.	unlimited

It will thus be evident that the order of depositions, as the water in the boiler becomes concentrated, is—

1. Carbonate of Lime,
2. Sulphate of Lime,
3. The Salts of Iron, as Basis or Oxides, and some of those of Magnesia,
4. The Silex and Alumina, usually with more or less of the Organic Matter,
5. Common Salt.

The carbonate of lime sometimes deposits as an amorphous mass, like hard, fawn-coloured chalk, but much more usually, especially in high pressure boilers, precipitates in the crystalline form, as arragonite (one of the dimorphous forms, of which cale spar is the other). The sulphate of lime falls as amorphous gypsum most commonly, but not unfrequeutly in small crystals of hydrated gypsum, (the water combined in unusual proportions, as in those discovered, some years ago, by the late Prof. Johnston of Durham, Reports Brit. Ass.) segregated or coherent as a hard crust—which latter forms the worst form of "boiler scale"—and when long exposed to high temperature, becomes changed to Anhydrite, with the form of crystal and hardness, of the natural mineral.

Recurring now to marine boilers, or those fed with sea or salt water—our second class,

We may take Bouillon La Grange and Vogel's analysis of the ocean water outside Bayonne, in the Gulf of Gascony, as a type of sea water. The total saline contents in a cubic foot of sea water varies, but within limits, in the ocean, and all the great tracts of navigation, that may be practically neglected. The freshest water is probably that of the Baltic and upper part of the Black Seas—sp. gr., about 1024. The upper limit of salt is in the water of the Dead Sea—sp. gr., 1240 nearly.

The following are the solid contents of 100 parts of the Gulf of Gascony:—

Chloride of Sodium, ...	2.510
Chloride of Magnesium, ...	0.350
Sulphate of Magnesia, ...	0.578
Carbonate of Lime and of Magnesia, ...	0.020
Sulphate of Lime, ...	0.015
Carbouic Acid (in solution), ...	0.023
	3.496

The essential solid elements, as regards our subject, are the lime, sea salt, and magnesia, in combination with sulphuric acid and chlorine, and very often in practice, that which analysis does not show, a vast amount of suspended muddy matter, which is pumped with the water into the boilers, as in the Ganges, Bristol Channel, &c.

In minute quantity sea water, however, also contains, potass, alumina, and various metals, with bromine and iodine.

The following table, by Berthier, shows the order and proportionate deposition of solid matter upon concentration, by boiling off steam from sea water, per 100 parts—

Saline Matter.	A Sea Water sp. gr., 1.0278	B Ditto Concentrated sp. gr., 1.140	C Ditto. Concentrated sp. gr., 1 220	D Ditto. Concentrated Salt nearly Deposited
Chloride of Sodium,	2.50	16 00	25 50	20.80
Chlor. of Magnesium,	0.35	0.46	1.07	4.85
Sulph. of Magnesia,	0.58	0.80	1.48	9.50
Carbon. of Lime and Magnesia, - -	0.02	0 00	0.00	0 00
Sulphate of Lime,	0.01	0 30	0.00	0.00
Sulphate of Soda,	0.00	2.65	2.81	0.00
Water, - - - -	95 54	79.79	69.14	64.85
	100	100	100	100

Thus when sea water is boiled down so that the water is only about 65 per cent.—*all* the salts of lime and magnesia—the whole of the sulphate of soda formed, and a large proportion of the sea salt, have been deposited, and these constitute the tough and hard cake of salt, with imperfect crystallization, arranged perpendicularly to the heated surface, *i.e.*, the shell, that is so destructive and inconvenient in marine boilers.

In the state of concentration of D, the sea water is a strong brine, with a high boiling point. The elevation of the latter is shown by the following table, from Faraday's past experiments:—

Volume of Sea Water.	Boiling Temper. at 30° Barom.	Saline Matter in 100 parts	Nature of the Deposit.
1000	214° Fah.	3.0	None.
299	217° "	10.9	Sulphate Lime.
102	228° "	29.5	Common Salt.

Thirty-seven parts of common salt saturate 100 of water, at all temperatures, if both be pure, according to Fuchs, but when the other contents of sea water are present, 36 parts saturate at 226° Fah , and 30 parts at 228°. The loss of solubility *augmenting* with the temperature, hence 10 volumes of sea water concentrated to one, becomes, in part, saturated brine.

Mr Couste has noticed also analogous facts with reference to the sulphate of lime.

We may now pass briefly in review, the several methods that have been proposed or tried for mitigating or preventing these injurious deposits. To attempt to go through these *seriatum*, or even the patented ones only, would be impossible, and a bootless labour. They may be classed however, under the following heads:—and first, as respects land boilers evaporating fresh-water.

1. Filtration of the water—an obvious preliminary that should invariably be adopted when the water contains suspended mineral matter, but which does not affect dissolved salt, for, although long continued filtration and moving contact with solids, such as flint pebbles, will deprive water even of some of its soluble contents, the process carried to this extent is too costly for our purpose.
2. The application of collecting vessels to the boilers. These are of two sorts. A, External close vessels, heated by otherwise waste flue heat, into which the feed water of the boiler is primarily admitted, and passes thence to the boiler.

   The function of such a vessel is that the lime held in solution as bi-carbonate, by the excess of carbonic acid dissolved in the water, is partially precipitated in the vessel as carbonate, the carbonic acid being driven off by the heat.

   This constitutes Brunton's Patent for Sediment vessels.

   It has also been proposed to adopt Dr Clarke's water purifying process to the feed water entering boilers, and to precipitate the bi-carbonate of lime by adding measured volumes of lime water, so as to form proto-carbonate. Like all other devices that aim at changing the water by chemical means, however, it is too delicate in application, and any excess of lime would obviously only add to the evil.

I may state here, upon the authority of my own researches of past years, that the carbonic acid is evolved, and the carbonate of lime begins to deposit, as soon as the feed water is heated to 190° Fah.—(Reports Brit. Ass. Reports on Iron Corrosion.)

B, Internal collecting vessels, proposed by many separate inventors long since, and patented several years ago by Mr Scott. These contrivances depend upon the fact that the solid matter when first separated from solution, and floating about in the agitated boiling water of the boiler, will find a resting place, and precipitate, *i e.*, collect, in any part of the boiler, where we may provide for it a quiet spot, free from agitation of the water.

Hence if a narrow necked vessel, as a bottle or pan, be placed within or hung up in a steam boiler, the water, though at 212° within it, does not circulate in brisk currents, and gradually the floating particles, as they pass its mouth, fall into this collecting vessel, deposit, and never return from it. This does in reality, constitute one of the most efficient means known of collecting the deposit to one point, so as to preserve the rest of the boiler surface free comparatively. It can be readily removed from the collecting vessel.

To this division belongs also the plan often adopted, of putting balls of wood, or brick, or stone, &c., into the boiler, which roll about with the agitated water, and segregate some of the deposit in coat after coat upon their surfaces. This notion is very ancient, and has been known in domestic life,—housewives putting a boy's marble into their tea kettles with a similar object.

The two methods, A and B, may be combined; and I have in my own practice found the combination advantageous,—an external sediment vessel heated by the waste flue heat receiving the feed water, and in it the greater part of the carbonate of lime is left; while internal collecting vessels in the boiler receive the greater part of the remainder, in combination with the sulphate of lime. This method also, though long previously in use, has been patented by Taylor.

3. The addition of foreign materials to the water of the boiler, with a view to prevent the aggregation of the particles of the deposit, and their adherence to the walls of the boiler.

The substances proposed with this end in view are numerous.

Potatoes, oatmeal, bran, saw dust, molasses, coal tar, charcoal dust, smiths' dust,—i.e., finely divided coke and ashes,—coal ashes, plumbago, soap, tallow, and many others, have been added in more or less bulk to the water in the boiler before closing the main lid after cleaning. All of these, and more especially such matters as potatoes or saw dust, possess some power of sub-dividing and making more friable calcareous deposits, and are not without some use when much sulphate of lime is present in the water, as they greatly interfere with its crystallization into massive crusts; but their effort is temporary, and all such additions are attended more or less with the serious evils of "priming," i.e., water being driven over with the steam into the steam pipes and valves of the engine from the boiler, and with it solid matter, which chokes the passages, spoils the valve faces, &c. To this class of mitigants belongs the useless and expensive nostrum long in use "by authority" in the Royal Navy, of coating the whole inside shell of the boiler (in steam ships) with tallow and black lead mixed together, under the notion that it prevented the adhesion of deposited salt. It is believed that this is long discontinued.

4. The addition to the water in the boiler, or to the feed water entering it, of chemical agents intended to render the less soluble salts in the water more soluble, and therefore less capable of forming deposits.

Very many of the nostrums that have from time to time been patented with this alleged object, have been incapable of any such action. They have often been educts of chemical or other manufactures, sought thus to be profitably got rid of, and not unfrequently of a character likely to be highly prejudicial to iron boilers. Thus soluble salts of arsenic and copper have been sold for this purpose. The chief agents that have been proposed with intelligent views, however, have been hydrochloric acid, more or less diluted; chloride of ammonium (sal ammoniac), which constituted the matter of Ritterbandt's patent of 1850 or 1851; and chloride of calcium (an educt of many chemical manufactures). None of these are particularly effectual. Hydrochloric acid is a perilous addition to any iron boiler, as a very slight excess, when continued, will remove a large proportion of the thickness of the shell of the boiler in solution, as chloride of iron.

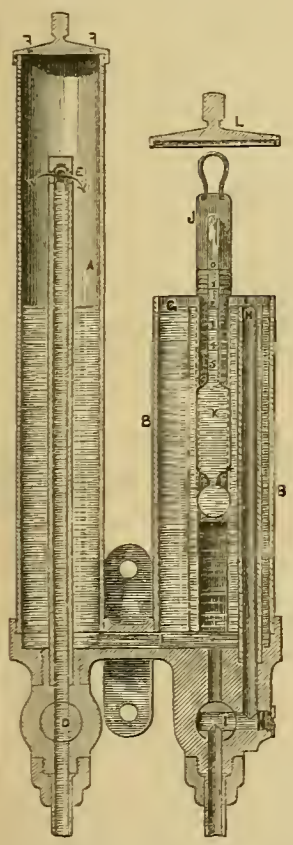
Sal-ammoniac and other soluble chlorides are not free from this risk (for in presence of organic vegetable matter, iron is capable of decomposing slowly even common salt, and by a remarkable train of decom-

position producing carbonate of soda, and evolution of free chlorine, which in turn reacts upon the iron), and none of these agents have any advantageous action upon water rich in sulphate lime.

Alkaline solutions, carbonate of soda, and caustic soda, have also been proposed, on the ground of their presence rendering the difficultly soluble salts of lime more soluble; but their action in this way is not marked, and the effect in practice is, that the alkaline water is carried up, more or less, with the steam into the pipes and engines, etc., and acts upon all flanges, joints, packings, paint, etc., as a destructive agent. Besides these, tan pit liquor, decoction of oak bark, catechu, and various other astringent substances, have been strongly recommended by their several proposers; and perhaps strangest of all, dyewood, and various vegetable colouring matters, constituted the subject of a patent of 1838,—of all of which we may safely say, that any other "chip in the porridge" would have been quite as useful.

Lastly, we arrive at the methods that have been proposed or adopted for mitigating or preventing deposit in marine boilers working with sea water.

In order of time, the first of these was the very primitive one of "blowing off," that is to say, that the sailing engineer, at stated intervals fixed by experience, permitted the feed pumps to work an excess of feed water into the boilers, and then blew off at the sea cocks fixed into the bottom parts of the boilers, thus removing at such operation some of the muddy deposit of saline matter at the bottom cells of the boiler, and with it some of the denser and more concentrated brine. Occasionally the order of the process was reversed, the blowing off preceding the feed in excess of the average consumption of water in steam, but with the danger of laying bare some of the flue plates when the water was thus lowered. However, like every "rule of thumb" method, and in common with all dependent upon personal care and continuous attendance, this was often perilously neglected; and in my own early practice as a mechanical engineer, I have known the London steam ships come into the port of Dublin with every "pocket" or side chamber, beside the furnaces of their boilers, choked up with one solid mass of salt, that could only be removed by cutting the side plates out and replacing them.



The inventions of Hall and others for providing marine engines with surface condensation, and hence working with fresh water only, the same water being evaporated over and over again, had amongst other objects in view the relief of this great evil; and it is now highly probable that eventually this form of engine will be made fully available, and will displace the use of feeding with sea water.

They failed at first, however, and the invention and perfecting of the boiler-feeding arrangements known as the Brine Pump, and of the Salinometer, displaced in all well provided steam ships the old system of blowing off.

The brine pump is an adjunct of the feed pump, and its function is to remove at each stroke of the engine a determinate volume of the water, withdrawn from that part of the boiler supposed to be most highly concentrated as a saline solution, while the feed pump supplies in its place a larger determinate volume of sea water in its natural state. The cold sea water to be pumped into the boiler is caused to pass through tubes immersed in the boiling saline liquid being pumped out by the brine pump, and robbing the latter of some of its heat, economises part of the fuel that would be otherwise wasted.

The salinometer (one of the earliest promoters, if not proposers, of which was Mr Scott Russell) is in fact an areometer or hydrometer, by which the specific gravity of the liquid within the boiler, and at various levels, may be tested. There are various constructions, some always presenting indications, more or less exact, of the density of the fluid actually within the boiler, others requiring a certain volume of the hot liquid to be drawn off for trial—all depend upon the common principle of the areometer, the floating or not, of bodies of known density immersed in the liquid, with adjuncts for correction as to temperature, etc.

The brine pump is often used without the salinometer—still oftener with it, but independently of its necessary control. But in the most complete arrangements, the salinometer itself is contrived so as to regulate the proportion between the volume of water withdrawn and that needed to be supplied by the feed pump.

This was done on board the *Don Juan*, as an early example by the salinometer (in this case a large copper sphere, with considerable buoyancy) acting directly upon the valves of the brine pumps and feed pumps. A want of sufficient mechanical power for complete and trustworthy control was, however, I believe, always found; and a much better arrangement, although one that I am not aware has ever been before proposed or tried, would appear to be the adaptation to this use of Dr Ure's thermostat—making the *temperature only* of the fluid in the boiler, or rather coming through the brine pump out of it, the rule as to saturation, and causing the powerful flexure of the thermostat bars (which may be quite immersed within the boiler or its pipes) to act directly upon the valves regulating the supply.

It scarcely needs pointing out, that no chemical, or other agents introducible to marine boilers, are capable of producing the slightest practical effect upon the enormous volume of water evaporated, and of saline matter in a state to deposit.

If the boiler contains 100 parts of sea water, and the parts evaporated for steam in a given time be $= s$, and if n be $=$ the volume pumped out in order to preserve the state of saline concentration constant at a, $=$ (a fraction) parts of solid saline matter; then, as there is 3 per cent. of saline matter in sea water (in round numbers)—when

$$3\ (s + n) = a\ n.$$

The amount of saline matter entering the boiler by the feed pump and removed by the brine pump will be equal; and in this case the brine pump must remove

$$n = \frac{3.s}{a - 3} \text{ volumes.}$$

If $a = 30$, which is the saturated point for common salt — one-ninth of the feed water must be removed by the brine pump, and as $\frac{1^n}{6}$, the fuel that will convert water into steam from a given temperature, will bring it to 212°, the loss of fuel by this inward influx of cold water to the boiler, and removal of boiling water, will be—

$$\frac{1^n}{6} \times \frac{1^n}{9} = \frac{1^n}{54} \text{ of the whole quantity,}$$

assuming that none of the heat were returned to the boiler by conduction, between the issuing and entering fluids, as explained.

This somewhat crude view of this part of our subject will serve to illustrate the main question, to the more complete solution of which M. Couste's Memoir is dedicated.

In concluding this paper, we may notice the improved salinometer of Long, which is much used in the steam ships of the United States.

These instruments possess many advantages over those hitherto used.

They are *constantly in action*, and the density of the water may at any moment be read off; while the engineer *cannot be scalded, nor the hydrometer broken*, as is so often the case with the ordinary instrument.

The Committee of the Franklin Institute advise the "more general use of this valuable gauge, which ought not to be neglected on any boilers using salt water, and they commend it to the notice of all engaged in the management of such boilers." By its use, a great saving of boiler and fuel is effected. See *Journal Franklin Institute*, February, 1860, page 141.

EXPLANATION.

The cylinder, A, is connected with the boiler by the pipe and stop-cock, D, the pipe being closed at the top, and having openings at the side, near the top, at E. The water coming from the boiler and passing the stop-cock, D, makes its exit through the openings, E; at this point the steam is liberated from the water, and escapes through the openings, F. The water falls into the cylinder, A, passes through the opening, C, and rises to the water level, G, in both cylinders; H is an overflow pipe to carry off the surplus water, and to keep up a *constant* current to maintain the water to be tested at the required temperature. By turning the stop-cock, I, both cylinders can be discharged through the waste-pipe. J is a thermometer. K the hydrometer. L is the cover for closing the case when not in use. Between the cylinders is a bracket for securing the instrument to the boiler bulkhead.

THE TRAFFIC OF LONDON.

The accompanying woodcut will explain the plan which Mr Asprey, of Bond Street, London, has devised for relieving the streets of the Metropolis, and especially London-bridge, of the crowding of vehicles, which has been for so many years so great a nuisance, and which is annually on the increase. Mr Asprey has had a model of about three feet square construeted, (on a scale of five feet to the mile) which he has placed in the International Exhibition, class 10, for the inspection of the public. The plan seems to us highly ingenious and worthy of serious attention, with a view to considering whether certain works now in

progress need be proceeded with when the same result with additional advantages may be effected at so much less cost. It is proposed to run a line of railway from the Loudon-bridge Station to the Fenchureh-street Station, crossing the Thames by the side of London-bridge on the east, with branch on the south side to the Charing-cross line, and a passenger station near the Monument. The through traffic might thus be accomplished without changing carriages. This plan would render unnecessary the bridge and extension from the Charing-cross line to Cannon-street, for which an Act of Parliament has been granted, the same objects being obtained at an immense saving of cost, with the important advantages gained of not only carrying the Westend traffic into the City, but continuing it through to the Blackwall and all other lines in connection, without changing carriages, forming a conneeting link between the whole system of railways North and South of London. The people of the North and East of London, would thus be conveyed direct from the North side of the river to the Crystal Palace. This would entirely effect the one great necessity of the day, viz., the relief of the traffic of London-bridge. Not one person, or conveyance of any kind for goods or passengers, would be required to cross the bridge for either of the railways, whether the destination were far or near, home or continental; the stations remaining as they now are, with the addition of one new passenger station on the Monument side, between Thames-street and the River, or at any other more convenient point, where an hotel might be ereeted.

The goods stations in the Minories and at the Brieklayers' Arms might remain the same, if both were required, all delay in the transmission of goods from one station to the other would be avoided, and much labour and money saved by sending all direct through by the rail. This would bring all fish from either coast direct to Billingsgate, and also give direct communieation with Leadenhall Market, the Coal Exchange, Custom House, Mark-lane, the Borough Market, &c., with easy access to the Bank of England, the Royal Exchange—indeed, affording great convenience to all parts, bringing the many thousands who go in and out of the City daily from the south side to a more eentral point, saving mueh valuable time, and avoiding the crowded and disagreeable walk, or ride, over London-bridge. This would also avoid the tedious journey from the West-end to the Feuchurch-street station, and relieve the City to some extent of the traffic.

The model has been placed in the Exhibition at the suggestion of many gentlemen of eminence connected with the engineering profession, by whom this plan has been highly approved.

TANK ENGINE FOR THE GREAT INDIAN PENINSULA RAILWAY, OF 5.6 GAUGE.

By Messrs Sharp, Stewart & Co., *Atlas Works, Manchester.*

Illustrated by plate 291.

This engine has been designed for working the Bhore Ghaut incline on the above railway, and is remarkable for its great power and favourable distribution of weight. Fig. 1, plate 291, is a longitudinal vertical section of the engine, fig 2 is a half transverse section, and fig. 3 a sectional plan corresponding to figs. 1 and 2.

The engine has inside eylinders, each of 20 inches diameter, and 24 inch stroke. They are placed, as usual, under the smoke box, and between the inside frames. These frames are of 1 inch plates worked out of the solid, their least depth being 12 inches. There are, in addition, outside frames, each eonsisting of two plates, 7-16ths thick, with 3½ inches of wood between them. Both inside and outside frames are continuous throughout the whole length of the engine.

The crank axle has four bearings, but the coupled axles, of which there are two, have bearings in the outside frames only. The coupling of these six wheels being effected, as usual in goods engines, with outside frames. In addition to these six coupled wheels, there are four others attached to a truck or bogie, which has a radial movement in a quadrant, under the smoke box of the engine. This bogie serves to support the front end of the engine, at the same time allowing it to pass round curves with greater ease and safety than if rigidly attached axles were used. To facilitate further the motion of the engine on sharp curves, the driving wheels are cylindrieal and entirely without flanges.

The four bogie wheels are each $2'.9''$ diameter, and the six propelling wheels are each $4'.4''$ diameter. The tyres throughout the engiue are of Krupp's steel, and are secured by Beattie's pateut fastening. Springs are applied to eacb bearing of the engine, of suitable material and strength; those acting on the outside bearings on eacb side of the engine being connected by compensating levers.

The valve motion is that eommonly known as the eirele motion, and is regulated, as usual, from the foot plate by a lever, serving to reverse the engine, as well as to vary the degree of expansion, according to the work to be performed.

It being important that ample break power should be provided for the descent of the inclines, a sledge break is fitted to the engine, by means

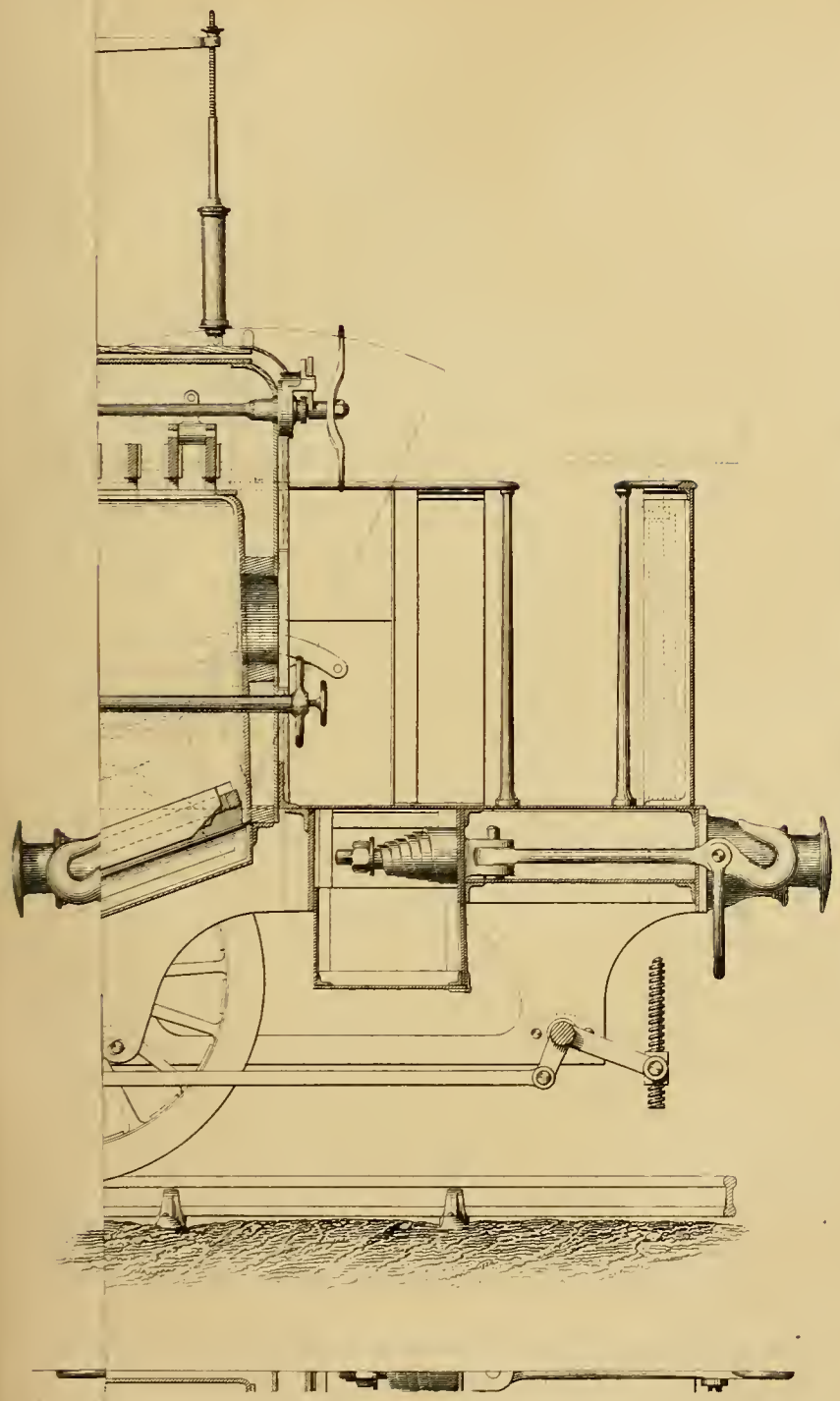


Fig. 2.

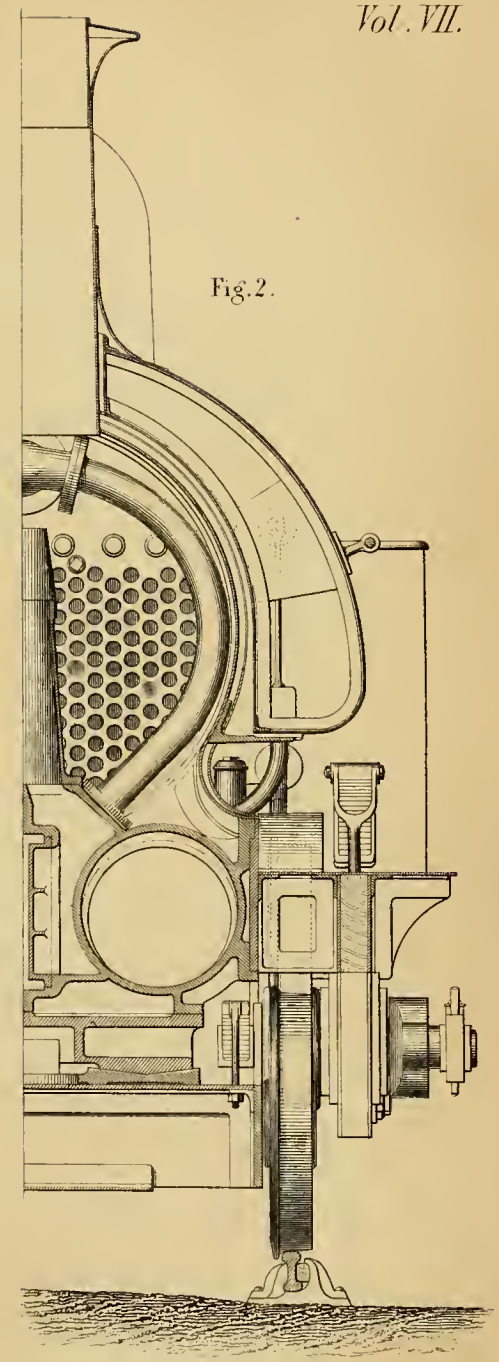


Plate 291.

TANK ENGINE FOR THE GREAT INDIAN PENINSULAR RAILWAY,

BY MESSRS SHARP, STEWART & Co

ATLAS WORKS, MANCHESTER.

1st SEPTEMBER 1862
Second Series
Vol. VII.

Fig.1.

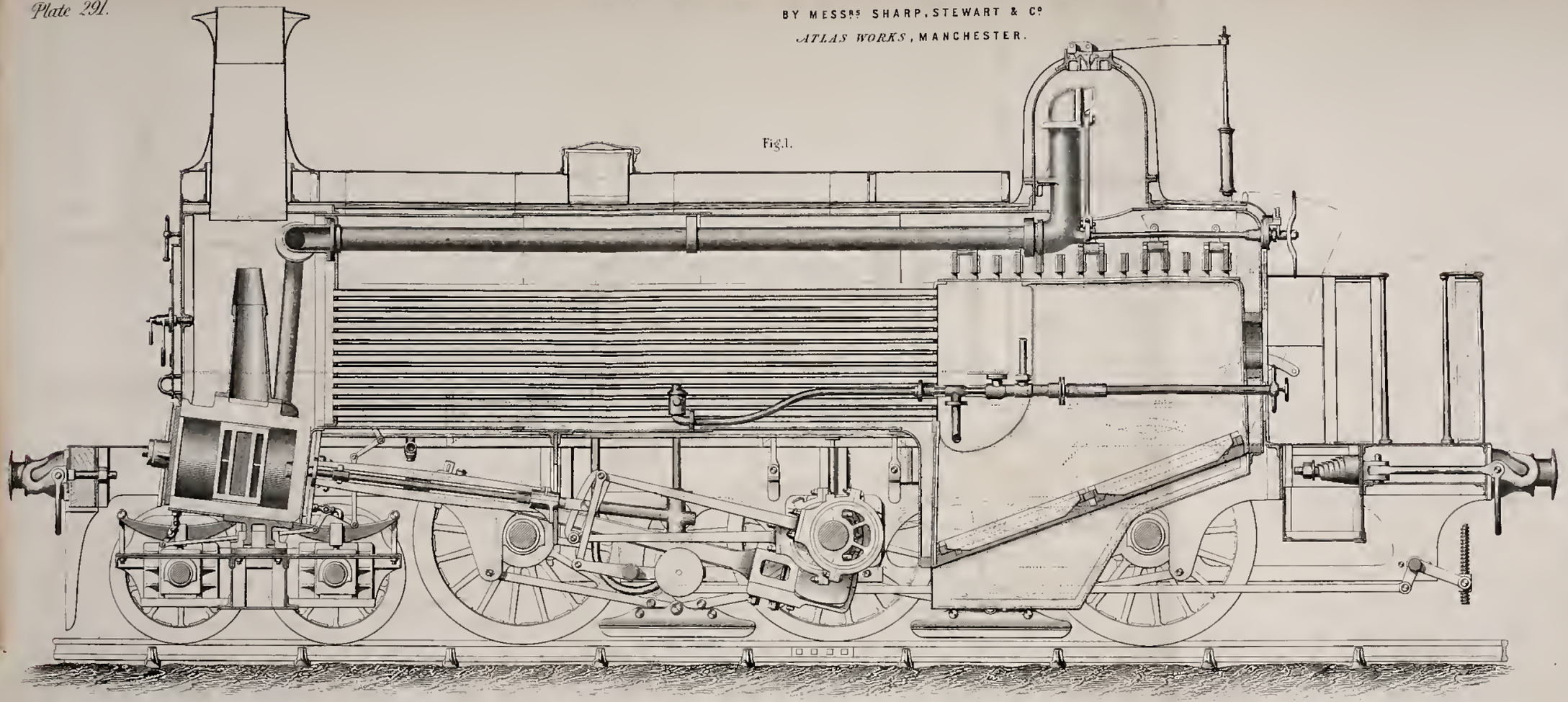


Fig.2.

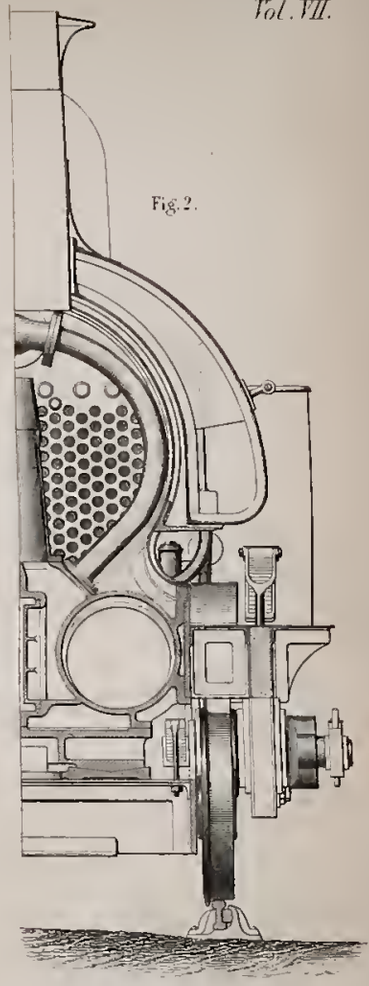
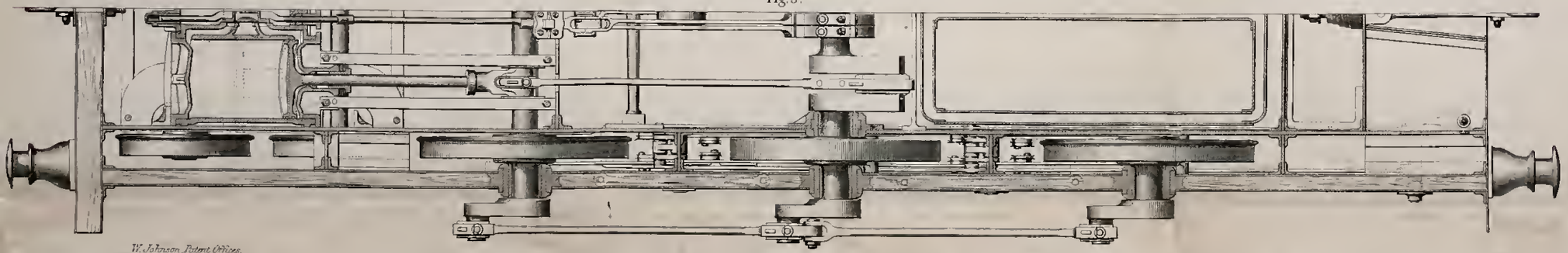


Fig.3.



W. Johnson, Patent Offices, 4 Inverleith Row, Fields & Glasgow

SCALE.

INS. FEET.

of which its whole weight can be taken off the wheels, and transferred to surfaces sliding on the rails.

The boiler is of the form called a plush boiler; that is, the top of the fire box shell, the barrel of the boiler, and the smoke box, are all on one level. A large steam dome is placed over the fire box, and, with the exception of the junction of this dome with the roof plate, no angle iron whatever is used in the construction of the boiler. Thus, not only is great strength and simplicity obtained, but a convenient seating is secured on which to fix the water tank for supplying the boiler.

The fire box is of copper, on Cudworth's system, having a longitudinal midfeather, with the grate inclined towards the back of the engine, thus allowing the trailing axle to be placed under the fire box, so as to reduce the distance between it and the driving axle. The heating surface of the fire box, including the midfeather, is 147 square feet, and of the tubes 1287 square feet, making a total of 1434 square feet.

The thickness of the copper fire box plates is $\frac{1}{2}$ inch, and of the tube plate $\frac{7}{8}$ of an inch. The iron plates of the barrel of the boiler are $\frac{1}{2}$ inch thick, and those of the outer shell of the fire box slightly thicker.

The fire box is stayed to the shell by screwed copper stays, and the roof with fourteen cross girder stays, of which five are connected by suspension links to the outside shell.

The size of the boiler is such as to give ample steam room in proportion to the heating surface. The boiler is fed by one pump worked from the cross head, and by one of Giffard's patent injectors, placed horizontally by the side of the fire box, and below the tank. This injector is sufficiently large to supply the boiler, under all existing circumstances, whether the engine is standing or running with a train.

The tank is of a saddle form, for the purpose of being placed over the boiler, will contain 1050 gallons, of which it is probable the engine will consume about 40 gallons per mile.

This new large engine will, when in working trim, weigh about 48 tons.

THE ARMSTRONG GUN COMPARED WITH RIFLED CAST IRON SERVICE GUNS (UNSTRENGTHENED) ON MR BASHLEY BRITTEN'S SYSTEM.

A LETTER TO THE RIGHT HON. WILLIAM MONSELL, M.P., CHAIRMAN OF THE SELECT COMMITTEE OF THE HOUSE OF COMMONS ON "ORDNANCE." BY BASHLEY BRITTEN.

Mr Bashley Britten has addressed a printed letter to the Right Hon. W. Monsell, on the subject of his communications with the War Department, as to rifling the existing cast iron guns in store in our arsenals, from which we extract the following passages, as of general interest, on the question of rifled ordnance, cast and wrought:—

Since 1854-5, when my proposal was first submitted to Government, I have been constantly urging the great importance of proper steps being taken to determine the question whether the service cast iron guns may not be rifled with advantage. Owing to the failure of several attempts to do this, by the application to these guns of different systems of rifling and projectiles, the question has been greatly embarrassed My object is now to bring prominently into notice the results of the trials which have been officially made with my system during the *eight years* it has been under consideration and trial; and, if possible, to show, that notwithstanding the failures that have occurred with other systems, there is good ground for believing that, by the application of my invention, this important object is attainable, with safety and economy. It must be understood, that it is not my purpose to maintain that cast iron is the best material for the construction of large guns. All I would urge is, that as the country is possessed of an enormous supply of guns of that material, representing property of a vast amount, it is not wise to allow them to continue in a less efficient state when, by a small expenditure, it is possible to improve their efficiency up to that higher standard which will alone warrant their being retained in the public service.

A careful study of the results of my experiments induces me to believe, that by a proper application of my system, and a due adjustment of the proportion of charge, it is possible to rifle any gun without materially weakening it, and to use it as a rifle, so as to render it more efficient than if it had merely a smooth bore, without subjecting it to any additional strain. I am, of course, aware, that in recent experiments against iron armour plates, it has been proved that smooth bore guns are more efficient at short ranges of 200 yards, than any Armstrong rifled gun that has been yet tried. Doubts, therefore, have arisen, in some minds, whether, after all, the smooth bore is not better than the rifled gun. But are the rifled guns which have been used, the best adapted for such work? It is well known that the force of impact from a projectile depends in a far greater degree upon its velocity than its weight. In the Armstrong gun, however, high degrees of initial velocity, and velocity at short ranges, are known to be sacrificed, in order to employ a long heavy projectile, which shall have a better sustained velocity for long range.

In the course of the investigation into the merits of my plan for improving our cast iron ordnance, the following guns have been used:—

			Inches.	Projectiles of about.	Rounds.
2— 9 pounders,	of 17 cwt.,	rifled in their full-sized bore of	4·2	15 lb. each	54
1—32 "	58 cwt.	" " "	6·375	50 lb. "	300
1—68 "	56 cwt.	" " "	6·41	90 lb. "	300
2—68 "	9? cwt.	" " "	6·12	90 lb. "	10 each
2—32 "				50 lb. "	10 each
1—32 "				50 lb. "	1100

Nothing has been done with a view to strengthen these guns. The rifling consists of merely a few shallow grooves planed out of the bore, about 1-12th of an inch deep, leaving broad lands between the grooves, of about an inch-and-a half to two inches wide, so that in firing common round shot from the rifled guns, the rifling would not be injured.

Not one of these guns suffered any unusual injury from these trials. With this fact before me, have I not a right to protest against the failure of other schemes essentially differing from mine—being taken as evidence against mine—and to ask, that my plan may be considered on its own merits alone, and that if enough has not yet been done, to remove all doubt upon the question, proper steps may be taken to have the subject decided without any further unnecessary delay?

The charges of powder which I have proposed for service with these guns, and generally used in the above trials, are so extremely moderate, that at first sight, they may be considered insignificant.

It is possible to use the force of gunpowder in such a manner, that it shall not do its greatest amount of useful work. The initial force of powder is not used to full advantage in very small bored guns, where, in order to use a sufficient quantity, the charge occupies a considerable length of the bore. The gas exerts a certain pressure in every direction. If, therefore, the charge is in the form of a long, narrow cylinder, it will have a large amount of surface to act against, upon the sides of the gun, so as to burst the gun, and a proportionably smaller area on the base of the shot, to give the latter velocity. In a large bore, therefore, a given quantity of powder will not only act against a larger area on the base of the projectile than in a small bore, but the projectile will absorb more moving force, because the whole space within the bore being greater, a greater degree of expansion is utilized, although the length of the gun may be the same. This will be exemplified in the comparison of the performance of my small charges with the larger charges and with the Armstrong Gun.

Before giving details, I must state, that I have not yet had an opportunity of fairly testing any gun for precision at the Government practice range. There are defects in the rifling of the Service Guns used at Shoeburyness, which I have pointed out to the authorities; and although I have applied several times for other guns to be rifled in the manner which I know, from private experiments, to be desirable, they have not yet been granted.

On the 6th of August, 1861, the following practice took place in the presence of the Ordnance Select Committee. The force of wind registered from 3 to 5, and its direction was across the range, at an angle of about 45 degrees. The 15 rounds which I shall take as an example, are the last shots fired at the practice ranges.

Practice with a Rifled 32-pounder Cast Iron Service Gun on Bashley Britten's System. Charge of Powder 5 lbs.; Weight of Projectile 50 lbs., including Bursting Charge of 3 lbs. 7 ounces.

Elevation.	Recoil.		Windage	Time of Flight.	Deviation from Line of Aim.	Range.
	Ft.	in.	Dec. In.	Seconds.		Yards.
2 degrees	9	4	·125	3·3	1 yard left	1112
"	8	9	·125	3·2	In line	1125
"	9	9	·135	3	2 yards left	1089
"	9	7	·125	3·2	1 yard right	1083
"	9	9	·124	3·2	2 yards right	1107
			Average	3·18		1103
5 degrees	9	10	·115	6·4	8 yards right	2088
"	10	0	·125	6 4	4 yards left	2106
"	10	0	·135	6 6	1 yard left	2119
"	10	0	·135	6 4	In line	2197
"	10	0	·125	6·4	2 yards left	2045
			Average	6·44		2111
10 degrees	9	7	·125	11·6	17 yards right	3523
"	10	4	·125	not seen	1 yard left	3454
"	9	6	·135	11·4	2 yards right	3469
"	9	7	·115	11	8 yards left	4456
"	9	4	145	11·8	3 yards left	3425
			Average	11·45		3465

Another 32-pounder of 56 cwt. fired 25th October, 1860, with similar charges and projectiles to the above, gave the following results at an elevation of 26 degrees; the day being calm.

Elevation.	Recoil.	Windage	Time of Flight.	Deviation from Line of Aim.	Range.
	Ft. In.	Dec. In.	Seconds.		Yards.
26 degrees	5 0	·12	26·8	9 yards left	5732
"	4 8	·13	26·1	3 yards left	5668
"		·10	not seen	5 yards left	5749
"	4 9	·13	26·5	16 yards left	5767
"	4 9	·11		20 yards right	5834
"	5 0	·13	not obtained	10 yards right	5646
"	5 1	·11		7 yards right	5734
"	5 2	·11		1 yard right	5837
"	5 1	·10		18 yards left	5720
"	4 9	·11		13 yards right	5828
"	5 0	·11		2 yards left	5669
"	5 0	·13		1 yard right	5842
		Average	8·8		5752

In order to compare the practice of the rifled 32-pounders and that of the ordinary smooth bore gun, at long ranges, I extract from an official report by Colonel Mitchell, from Shoeburyness, the actual results of seven successive shots fired May 13, 1859. As they were intended for comparison, every care was taken in laying the gun.

Practice with a smooth bore 32-pounder Service Gun.—Charge, 10 lbs.; Solid Shot, 32 lbs.; Elevation, 18⅜°.

Recoil.	Deviation from line of aim.	Range.
9 ft. 1 in.	14 yards left	2640 yards.
9 ft.	24 " right	2768 "
9 ft.	34 " right	2751 "
9 ft. 6 in.	22 " left	2802 "
9 ft. 5 in.	17 " right	2676 "
9 ft. 3 in.	14 " right	2665 "
9 ft. 6 in.	40 " left	2768 "
Average	23·3	2724· yards.

The above are not selected shots, but are all that were fired at that elevation on the occasion, and I believe this may fairly be considered as average practice of the smooth-bore gun at those ranges.

The only 68-pounder rifled on my plan, which has been tried at the Shoeburyness Practice Range, is very unsuitably rifled; nevertheless, I may venture to give the following details:—

Practice with a 68-pounder Rifled Service Gun of 95 cwt —Bore, 8 12; Charge of Powder, 7½ lbs.; Shell, 90 lbs.; Bursting Charge about 8 lbs.; Wind registered "In gusts 4 to 6" at right angles to the line of fire; Elevation, 2°.

Recoil.	Windage.	Time of Flight.	Deviation from line of Aim.	Range.
6 ft. 5 in.	·10	2·8	2 feet left	940 yards.
6 ft. 5 in.	·08	3	3 yards right	969 "
6 ft. 7 in.	·08	3	1 foot right	1000 "
6 ft. 6 in.	.08	2·9	3 yards left	941 "
6 ft. 5 in.	·07	2·9	6 yards right	1004 "
6 ft. 5 in.	.08	3	3½ yards	1004 "
6 ft. 9 in.	·08	3 1	6 yards left	1008 "
Average		2 96		981 yards.

I think a fair view of all the results of my experiments justifies my stating generally, that the following advantages may be gained by rifling the old guns:—

1. At nearly 6000 yards range the Rifled Service Guns have considerably more precision than the Smooth Bores command at less than 3000 range, and consequently, they have a serviceable degree of efficiency at more than twice the distance that these guns at present can be used for.

2. The Rifled Guns throw shot or shell about fifty per cent. heavier than the round solid shot, and the shells will carry a bursting charge of more than three times as much powder as the round shells.

3. The shells may be constructed on the segment plan, or to hold molten iron.

4. The rifling employed will in no way interfere with the use of the round shot, and the ordinary service charges whenever they may be required for hard hitting at short ranges. The round shot would have no more lateral play in the bore in consequence of the rifling.

5 These guns will therefore combine the advantages of the rifled and smooth bored guns.

The cost of rifling these guns at Woolwich is under 20*s* each. The guns are loaded by means of the ordinary rammer as easily with the rifle projectiles as with round shot. The rifle projectiles are not tight fitting, but when put into the gun, have a windage of nearly ⅛th of an inch. They do not require to be fitted into the bore in any particular way, as there are no projections on the shot to be adjusted in the rifling. The action of the powder causes them to expand, so as to cut off the escape of gas, and to fill the grooves. They are not expensive, and no objection is raised to their employment by any practical artillerist.

Before proceeding further it is as well to state, that besides the trial of endurance given to the several guns which I have mentioned, another trial of a much more searching character has been made.

At the desire of the Ordnance Select Committee, in 1860, two 68-pounder guns, and two 32-pounders were ordered to be taken indiscriminately from store, and rifled in accordance with my plan, and then tested to destruction in the bursting cell at Woolwich, with increasingly heavy projectiles made upon the same principle as those proposed for service. We can only give space to the particulars of the final round in each case.—

32-pounder of 58 cwt.; 5 lbs. powder; 4 rounds; 168 lbs. projectile. (Gun burst, having stood 53 rounds.)

32-pounder of 58 cwt.; 5 lbs. powder; 7 rounds; 168 lbs. projectile. (Gun burst, having stood 56 rounds.)

68-pounder of 95 cwt.; 7½ lbs. powder; 10 rounds; 315 lbs. projectile. (Gun burst, having stood 59 rounds.)

68-pounder of 95 cwt; 7½ lbs. powder; 10 rounds; 405 lbs. projectile. (Gun not burst, having stood 79 rounds.)

I now propose to institute a comparison between the efficiency of my Rifled Service Guns, and that of the Armstrong Guns. Considering the very small charges that I am limited to with these weak guns, this may appear presumptuous. I have repeatedly made application to the authorities for a gun of strong material, but hitherto it has been denied. In 1860 I was informed by the Secretary of the Ordnance Select Committee at Woolwich, that a recommendation would be made by that body to the War Office that a gun of strong material should be prepared for the purpose of testing my system with the muzzle-loading shunt system proposed by Sir William Armstrong, but for some reason that I am at a loss to account for, this recommendation was never acted upon. I enter, therefore, upon a comparison of this nature at every possible disadvantage. I have had to work out my invention by myself in the face of many difficulties and restrictions. The only practice I can refer to, was with guns which I know are not rifled, so as to give the best results. No doubt there are also modifications of detail in the construction of my projectiles to be found out by experience, which would possibly improve them.

On the other hand, the Armstrong Guns represent a system which has been rendered as perfect as it is capable of being rendered, by the trial of countless changes, the command of unlimited resources, and the assistance of the combined talent of the chief military and civil engineers of the country. Notwithstanding all this, I invite very particular attention to the comparison of the figures in the table I subjoin. The facts here given are all drawn from official resources. Those relating to the Armstrong Guns I extract from the *Hand-book for Field Service*, by Lieut.-Colonel Lefroy, the secretary of the Ordnance Select Committee. Those relating to my own gun are from the official reports of practice:—

Comparison of Ranges, Velocities, &c., of the Armstrong Guns, and Bashley Britten's Rifled Cast Iron 32-pounder Service Guns.

GUN.	Original Cost of Gun.	Weight of Projectile.	Charge of Powder.	Proportion of Charge of Powder to Weight of Projectile.	Initial Velocity.	Range and Velocity, at 2 degrees.			Range and Velocity at 5 degrees.			Range and Velocity, at 10 degrees.		
						Range.	Time of Flight.	Mean Velocity	Range.	Time of Flight.	Mean Velocity	Range.	Time of Flight.	Mean Velocity
		lbs.	lbs. oz.		Ft. per Sec.	Yards.	Seconds	Ft. per "	Yards.	Seconds	Ft. per "	Yards.	Seconds	Ft. per "
Armstrong 100-ponnder, Bore 7 in. Length of Bore 99·5	£510	111	12	$\frac{1}{9 \cdot 2 5}$	1124·7	1010	3·2	946·9	1970	6·8	869·1	3470	12·3	846·4
Armstrong 40-ponnder, Bore 4·75 inches, Length of Bore 106·37 .	£250	40	5	$\frac{1}{8}$	1164·4	1095	3·35	980·6	2160	6·65	974·4	3835	12·6	913·1
Armstrong 20-pouuder, Bore 3·75 inches, Length of Bore 84· . .	£125	20	2 10	$\frac{1}{8}$	1114·3	905	3·1	875·8	1850	6·4	867·2	3250	11·9	819·3
Cast-Iron Service Gun, Rifled on Bashley Britten's plan, Bore 6·375 inches, Length 103· . .	£65	50	5	$\frac{1}{10}$	1209·2*	1103†	3·2	1034	2111	6·45	981·9	3465	11·45	920·2

* Determined by Ordnance Select Committee with Navez's Electro Ballistic Apparatus. The actual weight of Shell used was 50·36 lbs., charge 5 lbs.
† These are averages of five rounds at each elevation; the last fired at Shoeburyness.

It will be seen by these figures, that notwithstanding the small charges I can only employ with Rifled Cast Iron Service Guns, the results I obtain can hardly be said to be in any way practically inferior to those obtained with any of the Armstrong Guns, but that in several points of extreme importance there is a very positive superiority in the cheap and simple Rifled Cast Iron Guns.

The force of a projectile for impact may be expressed by multiplying its weight by the square of its velocity.

Comparison of the work done, by eqnal charges of powder, fired from the Armstrong 40-pr., and Bashley Britten's Rifled Cast Iron 32-pr. Service Gun.

Initial.	Armstrong. Charge 5 lbs. Weight of Projectile 40 lbs.			Rifled Service Gun. Charge 5 lbs. Weight of Projectile 50 lbs.		
	Range.	Velocity Squared × Weight.	Results.	Range.	Velocity Squared × Weight.	Results.
		$1164{\cdot}42 \times 40$	54,233,094		$1209{\cdot}2 \times 50 =$	73,108,232
at 2 deg.	1095 yds	$980{\cdot}6^2 \times 40$	38,502,278	1103 yds.	$1034{\cdot}2 \times 50$	53,457,800
at 5 deg.	2160 ,,	$974{\cdot}42 \times 40$	37,978,214	2111 ,,	$981{\cdot}22 \times 50$	48,206,380
at 10 deg.	3835 ,,	$913\ 1^2 \times 40$	33,350,064	3465 ,,	$920{\cdot}2^2 \times 50$	42,338,402

I have before allnded to the possibility of the force of a charge of gunpowder, like any otber force, being employed disadvantageously, and the only conclnsion I can arrive at from the above figures is, that a remarkable instance of this is here shown. In the Armstrong gun means are taken effectually to prevent all windage or escape of gas over the projectile. With my gun, however, I know that a certain quantity of gas does get by the projectile in the gun; hut, notwithstanding this, it will be seen that similar charges of 5 lbs. of powder fired from the two guns, the bores of which are about equal in length, give very different results. The useful work done in imparting force to the projectile is greater with the Rifled Service Gun than the Armstrong Gun, in the large proportion of 73 to 54. Moreover, although in the instance of the Rifled Service Gun, with its larger bore, the projectile during flight is retarded by the resistance of the air, on an area of about 31·5 square inches, while in the longer Armstrong projectile this area is only about 17·5 square inches, it is still found that at a range of more tban 3000 yards, my projectile appears to maintain a superiority of force in about the proportion of 42 to 33. The question arises, which gun is best adapted for throwing shells. On this point I may quote the high authority of Sir William Armstrong * That gentleman stated—"*the power of a shell depended upon the magnitude of its bursting charge, and a large bursting charge involved a large diameter. A shot of large diameter, by making a larger hole, and producing more splinters and greater displacement, was in general more efficacious than a long narrow bolt.*" The shells I have used in the practice referred to, contain a hursting charge of 3 lbs. 7 oz. of powder, while the bursting charge of the 40-pounder with which it is compared is only 2 lbs. 8 oz. The bursting charge for the 90 lb. shells I nse for the rifled 68-pounder Service Gun is nearly 8 lbs., while that for the Armstrong 100-pounder is only 5 lbs.

Is then the Armstrong breach-loading Gun correct in the principles on which it is based? *A perfect gun should utilise all the powers which it possesses, whether in the strength of its material or the force used with it.* Here we have two guns compared, one extremely strong, the other very weak. To both are entrusted the same force, yet the weaker gun gives out far greater power.

Now, if the system which I advocate has been found so far practically successful when applied to weak guns, I submit that it is only just to afford me a fair chance of applying it with advantage to strong ones. There is nothing that I know of to render the system less likely to succeed with large charges than with small ones, or with guns of any size. It has been said that because in my system I employ lead at the base of my projectiles, therefore large charges cannot be used with them. This is entirely without truth.

As I think that the success which has hitherto attended my efforts entitles me to some consideration, I have lately renewed my former application to the War Office for a strong gun to be prepared for the further trial of my system, and I have stated the nature of the gun I should prefer. I hope this will be granted, but the application is still under consideration. If, therefore, the great problem now to be solved is, how is the *most powerful gun possible* to be constructed? I think the first step is to settle the principles which govern the question. I have attempted to explain my views on this point, and the conclusions I arrive at are apparently opposed to the views of our two great authorities on the question of rifled guns. While Sir William Armstrong and Mr Whitworth adhere to the employment of long narrow bolts and long narrow cartridges, and a sharp twist in the rifling, I consider a very much slower twist, and shorter projectiles to be best, conceiving that the powder so applied as to act on a larger area in the shot, and at the same time a smaller area on the gun, economises the force to be used, and the means possessed of controlling it. The most powerful gun that ever can be made will eventually prove to be that in which the principles regulating the economic use of power have been most faithfully respected.—I have the honour to be, Sir, your very obedient Servant,

BASHLEY BRITTEN.

Ren Hill, Surrey, 24*th July*, 1862.

* Discussion at the Institution of Civil Engineers, published by the Institution in 1860.

THE ADMIRALTY AGAIN.

Better than any additional comment that any one could make upon the subject of Mr Scott Russell's able pamphlet as to Admiralty incapability, which we reviewed last month, is the following statement as to the upshot and issue of the autocratic method, by which "my Lords" proceeded; when at length duly advised that Captain Coles cupolas would have in the very course of events to be tried. Disdaining to permit the inventor himself, whose invention they were about to try, to have any voice in adapting the ship, to the thing it was to carry, they have, it appears, cut down a new line-of-battle ship, and after the job is done, now find out that all they have accomplished is simply to spoil a ship, and make her useless for any purpose whatever.

The question was whether Captain Coles should be allowed any personal supervision in the process of converting a line-of-battle ship into a vessel after his plan. Every one, of course, felt that there was but one official body, even in England, which would deny the expediency of allowing an inventor to have a voice in the carrying out of his own invention. If the abstract story could have been told without mention-

ing the names, or the nature of the invention, we should all have cried out "It is the Admiralty." An original idea in a British Post Captain is a portent which puzzles and alarms Whitehall. Like theatrical managers, the directors of our naval affairs will have nothing but adaptations from the French. Had shield ships been building for three or four years at Toulon, and had Captain Coles been "deputed," after "due consideration," to inspect and report upon the new structures, it is quite certain that he would have been selected to superintend any imitation of them which was to be added to the naval force of the country. But, instead of being a good steady officer, with a firm belief in their Lordships' wisdom and the invincibility of their last second-hand design, Captain Coles was provokingly inventive. It was irritating to think that, as they had comfortably settled down to the construction of a fleet of Warriors, the mischievously active brain of one of their subordinates had originated something entirely different, and that new plans, experiments, estimates, speeches in the House of Commons, and all the accompaniments of naval progress, would be once more necessary. There is not, we believe, the smallest ground for rejecting Captain Coles's claims to a share in the conversion of these line-of-battle ships, except that he has given trouble to the Admiralty by suggesting the plans on which the Monitor has since been built by the Americans. However, when the first of these ships was to be converted, Captain Coles was requested to prepare the drawings for the shields, and given to understand that, as the rest of the vessel did not come within his scope, the work would be done without any consultation with him. In the construction of the Prince Albert, which is now being built by Mr Samuda, Captain Coles was not allowed to interfere in any way, and when he declared that he could not be responsible for any deficiencies or shortcomings, Lord C. Paget entirely admitted this, and explained that Captain Coles was not responsible for the ships, but only for the shields. That the shield and the ship were in any way mutually dependent, or should be adapted to each other by the action of one controlling mind, is an idea that does not seem to have been grasped by the naval authorities.

We have now an indication of the scientific powers of the Admiralty in the fate of the Royal Sovereign, a first-rate, which a few weeks ago was placed in the hands of the shipwrights to be made into a Coles shield ship, without the interference of Captain Coles. The inventor was ordered to prepare drawings of the towers and shields, while the vessel itself was placed in the hands of the Master Shipwright at Portsmouth to cut down as quickly as possible in accordance with drawings furnished by somebody or other, but not by Captain Coles, and not after consultation with him. The consequence is that the position of the guns and their line of fire will be such that it is absolutely impossible that they should hit anything that is not at a considerable distance. Having "razeed" the noble and entirely new vessel, they find that, as a consequence, "the muzzles of the guns in the shields will be about 20 feet from the ship's side, the latter being seven feet above the water line. Drawing a line from the muzzle of the guns, when at their greatest possible depression, to the point at which their shot would strike the hull of a ship's launch or gunboat on the water, it is evident that there must be always a considerable space round the Royal Sovereign where a large number of such craft could lie out of all danger from the guns of the shield ship." It is plain to the commonest intelligence that if guns are to be fixed in a cupola in the middle of a ship's deck, the cutting away of the upper part of the ship until it becomes broad and flat like a barge must effectually prevent the said guns being used against anything in the immediate neighbourhood, it being obviously a requisite of such a vessel that it should be narrow in proportion to the height of the guns above the water. At the cost of one of the finest vessels in the British navy the Admiralty will receive this elementary lesson in construction. At the present time they have just learnt that a "razeed" vessel with cupolas of small diameter is likely to be battered to pieces by any craft that can close with her. Having made this discovery, they give up the Royal Sovereign, which has by this time cost more than a quarter of a million, in the hope that Captain Coles may be able to make something of her. After two or three similiar failures, they will probably admit that the shield and the ship have some connexion, and that the same man may be not unprofitably consulted as to both.

THE METROPOLITAN MAIN DRAINAGE WORKS.

We condense the following, principally from an interesting account of this great work, which recently appeared in the *Times*. The main drainage of London, as now carrying out, for good or for ill, is undoubtedly the vastest work of the sort that the world has ever known—one before which the Cloaca Maxima of Rome—a thing by the way absurdly over-rated by the engineering ignorance of antiquarianism—sinks into perfect insignificance. The change it will effect on the cleanliness of the city, and on the health of the inhabitants, will be most important; but, in order fully to understand what is the improvement, it will be necessary to say a few words about the old system which the new is to supersede.

The subterranean web of drains and sewers which burrows beneath London is said to be more than 2000 miles in length. There is, however, a dark side to this picture, and that dark side, as our readers can easily guess, is the Thames. It is in vain that we speak of our drainage, and point to the hundreds of miles of sewers and drains which have been added to London within the last ten or fifteen years. Every new drain, in fact, only increased the evils of a system which at last became unendurable, and which, but for the means which have been taken to abolish it, must have made a plague spot of the whole metropolis. The only matter for astonishment is that our costly and incessant efforts to poison the air and water have not been thus punished long before this. It is the knowledge that in the ordinary course of events a visitation of this kind could not be much longer averted that has led to the great main drainage scheme being undertaken.

Of the general features of this plan we propose to give an outline. Until the adoption of the present scheme the object of all London drainage was to make the Thames the great main sewer of the metropolis, an object which we shall see was realized to the fullest possible extent. All the sewers in London on both sides of the river run due north and south, discharging themselves into the Thames within a length of some five or six miles. At the very first glance this arrangement seems bad enough, though it is infinitely worse when we come to examine how it was arranged to work. On both sides of the river the banks are very little above high-water mark, while the average level of the ground immediately behind them is much below it; half Lambeth, Bermondsey, and Rotherhithe being six feet below high-water level. Of course, when this is the level of the ground the sewers are much lower still, and their outlets so completely tide-locked that it is only at dead low water that they can empty themselves at all. Thus, for nearly 18 hours out of the 24 the sewage on both sides of London used to be, and is still to an immense extent, pent up, giving off its miasma into every street and house. As it could only escape at dead low water, the returning tide immediately churned it *up* the river, keeping all its abominable "flotsam and jetsam" above bridge till the tide ebbed out, finding 200,000 or 300,000 gallons of filth to be operated upon in a similar manner on its return. This was the arrangement 12 years ago, and is almost entirely so still; but, even had as this was, it was capable of being made worse, and worse accordingly it was made. In 1849 most of the houses in London had cesspools attached to them, and a very large proportion were without any drains at all. The alarming nature of this evil showed itself slowly but surely in the Bills of Mortality, and the then Commissioners of Sewers, who were feebly battling with the evils of the drainage system, set to work to mitigate the cesspool danger by drainage, making the Thames, as usual, the general receptacle. From that time to the present, some 700 or 800 miles of new drains have been made, and all cesspools made to drain at once into the river. By this "improved" drainage some 200,000 additional gallons of sewage were daily added to the Thames at low water, containing no less than 300 tons of "organic matter," which in this case is the scientific term for filth. Nor was the Thames the only sufferer. Wherever a stream could be found, no matter how clear its waters or how beneficial its course, drains were at once made into it. Hackney Brook, once well-known to anglers as one of the clearest and prettiest of streams that wound from the north of London into the river Lea, was made to vie with the Thames in filth and stench; and even the Serpentine was brought into requisition, and the Ranelagh sewer (one of the largest in London) daily discharged itself into that much-prized piece of ornamental water. The Thames, however, as the largest claimant, always got the preference of dirt, and the great mass of corruption which has flowed into it year after year has at last made it the largest and dirtiest open sewer in Europe. The result, as a matter of course, has been that in the summer months the stench from the river has occasionally been intolerable. In 1857 great quantities of lime and chloride of lime were put in daily; in 1858 the same expedient had to be resorted again; and in 1859 the dose had to be increased to 110 tons of lime and 12 tons of chloride of lime, costing some £1500 per week. Even in a pecuniary point of view, however, this was not the only evil of the system. The Thames in this hot weather runs short of water, and when there is no rain the collections of refuse in the sewers have to be flushed into the river by artificial means. This flushing alone during summer costs £20,000 a-year to get the poison into the Thames, where £20,000 more is generally required to keep it from breeding a plague. The tide in summer carries off little or nothing. A marked object set afloat in the river went backwards and forwards between Vauxhall and London bridges for three weeks without going much further either way. Of course, the sewage of the Thames, increased by its daily contribution, goes backwards and forwards likewise under the summer sun.

This great work may best be briefly described as consisting of three main tunnels or sewers on each side of the river. These completely divide underground London, from west to east, and cutting all existing sewers at right angles intercept their flow to the Thames, and carry every gallon of London sewage under certain conditions into the river on the north side below Barking, and on the south to near Erith.

These main drains are ealled the High, Middle, and Low Level sewers, aeeording to the height of the loealities which each respectively draius. The High Level on the north side is about eight miles in length, and runs from Hampstead to Bow, being at its rise only 4ft. 6in. in diameter, and thence increasing in circumference, as the waters of the sewers it intereepts require a wider eourse, to 5 feet, 6 feet, 7 feet, 10 feet 6 inehes, 11 feet 6 inches, and at its termination, near Lea river, to 12 feet 6 inches in diameter. This drain is entirely finished and in full work. Its *minimum* fall is two feet in the mile, its *maximum* at the beginning nearly 50 feet a mile. It is laid at a depth of from 20 to 26 feet below the ground, and drains an era of 14 square miles. The Middle Level, as being lower in the valley on the slope of which London is built, is laid at a greater depth, varying from 30 to 36 feet and even more below the surface. This is nearly complete, and extends from Kensal-green to Bow. The Low Level will extend from Cremorne to Abbey Mills, on the marshes near Stratford, but as the city portion of this will pass through the Thames Embankment we shall have oecasion to refer to it hereafter. At Bow the Low Level waters will be raised by powerful engines at a pumping station to the junction of the High and Middle Level ducts, thence descending by their own gravity through three tunnels to the main reservoir and final outfall below Barking. These three tunnels are each 9ft. 6in. in diameter and nearly four miles long. Great engineering difficulties existed in the construction of these main arteries, as, from the height at which they all meet, it was necessary to take them above the level of the marshes leading to Barking. For a mile and a half the embankment whieh encloses the three tunnels is earried on brick arches, the piers going 18ft. below the surface, and being based on solid conerete. Apparently this ground had not beeu distnrbed for very many eenturies. In the course of the excavations Roman and early British pottery was found, with skulls of an almost totally different type from the skulls of the present day, with quaint weapons, flint spear and arrow heads, rough knives, and horse accoutrements in iron. In the marshes at Barking the reservoir for the reception of the sewage of the north side is formed. This reservoir is a mile and a-half long by 100ft. wide and 21ft. deep. It is made of this great length in proportion to width to allow of its heing roofed with brick arches, which are again covered with earth to a considerable thickness, so that not the slightest smell or escape of miasma ean take place. This reservoir is eapable of containing more than three times the amonnt of sewage which ean enter it while the pipes which communicate from the bottom of the reservoir to the bed of the river remain closed. In fact, the whole scheme of the main drainage has been carried ont on the principle of making all the works large enough to meet the demands of future generations for almost the next two centuries to come. Thus, when all is complete, the works will not only he large enough to take off all London sewage now, but its sewage when Loudon is double its present size.

While the sewage is in the reservoir we have spoken of, it will be completely deodorised hy an admixture of lime. When the tide is at the height the sluices, which pass from the bottom of the reservoir far out into the bed of the river will be opened, aud the whole allowed to flow away. It takes two hours to thus empty the reservoir, by which time the tide will be flowing down strongly, and will carry its very last gallon a distance of 13 miles below Barking, which, being itself 13 miles below London, will place the contents of the sewers, every 12 hours, 26 or more miles distant from the metropolis. Thus, instead of letting loose the rankest of this great city's abominations in the very midst of London, and leaving it to stagnate, or, still worse, to be agitated backwards and forwards in a small body of water, it will all be carried away a distance of 13 miles, then deodorised, then suffered to escape into a body of water more than a hundred times greater than that into which it now crawls, and thus disinfected and diluted, so as to he without either taste or smell, swept still further down tbe stream, till every trace of it is lost. Many competent persons, however, are of opinion that the sewage of London possesses considerable value as liquid manure, and ought not to be thus wasted; but without at all discussing this question, on which there are many discordant opinions, we may say that arrangements are about being entered into between the Board of Works and a company which proposes to bring the question to a practical solution, and to apply the sewage as manure, for a certain time and under certain conditions. This attempt to utilize the sewage will be made on a large scale, and according to the best plans, so that one way or other the question as to its value will be set at rest for ever.

On the sonth side of the Thames the three great sewer arteries are constructed on similar plans. The High Level commences at Dulwich, and runs to Deptford Creek; the Middle Level begins at Clapham, and ends at the same terminns; and the Low Level will be from Putney to Deptford. At this point is to be a pumping station (now nearly finished), which, like that on the north side, will raise the water from the south Low Level to the channel of the High Level, whence both streams will flow of their own gravitation throngh a tunnel 10ft. 6in. in diameter to Crossness Point, in the Erith Marshes. One part of this tunnel passing under Woolwich is a mile and a half long, without a single break, and carried at a depth of 80 feet from the surface. At the outfall will be auother pumpiug station to lift the water to the reservoir. The southern reservoir is only five acres in extent; that on the north is 14. In the reservoir it will be deodorized and discharged iu a similar way to that we have already described. The pumping stations will each consist of an engine-house, containing ten boilers calculated to work up to 500-horse power nominal. This power working through eight pumps of 7 feet diameter and 4 feet stroke will daily raise 19,000,000 cubic feet of sewage from 19 feet below low water to the level of the outfall, but, in ease of necessity, the pumps can raise 25,000,000 cubic feet per day. Any of the main sewers can be disconnected if necessary from the others by meaus of sluice gates, and the ehimneys of the pumping stations themselves are used to draw off and consume the foul air iu the sewers. The total length of the three rows of intercepting sewers, the course of whieb we have sketched on each side of the river, will he 50 miles, and before all the works are eompleted 800,000 eubic yards of concrete will he eonsumed, upwards of 300,000,000 of bricks, and 400,000,000 eubic yards of earthwork.

There are many other points of special interest connected with this gigantic scheme, but into which we have no space to enter now.

The *Times* thus "tells the tale as told to it," and with the undoubtiug faith in results, which is usually inspired by haviug the projector's own statement of the means.

A fair case has elsewhere been established, we think, for the adequacy of those means to the main end in view—which is not, as tbe preceding account would appear to make it, to supersede the existing underground sewerage of London, nor even materially to improve it in any way—but simply to get the final accumulated product brought to two points so far down the river that it is supposed it will he iusensible aud innocuous when discharged into the Thames.

There are competent persons, however, who entertain great misgivings as to this result, and who believe that the immediate neighbourhoods of these mighty filth tanks, and mouths disgorging putridity, at Barking and Erith, will become uninhabitable; and that the first consequence of the "grand scheme," costing £4,000,000, will be to prove tbe necessity of a supplementary grand scheme to get rid of the eonsequences of the first. Perhaps in any other hands than those of the somewhat obstinate and strong willed man into whose professional eharge the early decisions as to this work mainly fell, nothing would have been donc; and we may congratulate ourselves on having got fairly hitcbed on to a work that ought not to have heen so long postponed—and so are committed to find the issue, and make it answer now, at whatsoever cost ultimately.

Our own view has always been that the accumulated sewage sbould never be discharged into the Thames at all, nor anywhere, but that, pumped up to a sufficient height, it should be passed on, in a continuous iron aqueduct, on piers, &c., with the means of distributing by lateral adjutâges at every quarter mile, such portion as could be consumed (unaltered and undiluted) upon the land, and that the residue, *if any*, should at last be passed into tbe German Ocean.

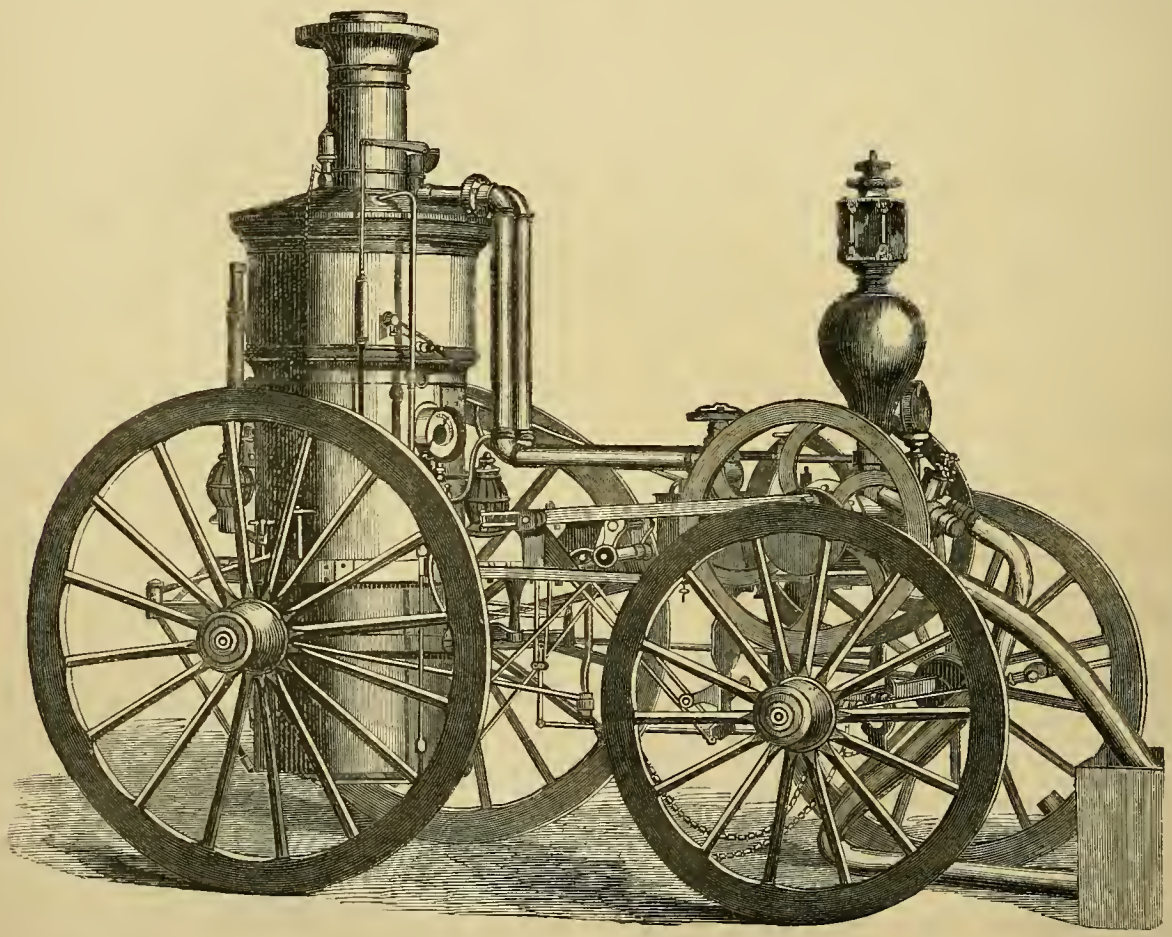
The engineers charged with the formation of the project now being carried out, however, would not listen to anything that even indirectly contemplated making the sewage of any agricultural use. According to them, *at that time*, nothing was so utterly preposterous—so steeped in ignorance and error—as to suppose that sewage was worth *anything*; that it *could* be applied to the land on a large scale with profit, or could be deodorized in such colossal masses by any means that would pay.

A very remarkable change, however, appears to bave come over their views since; and now that the work is indisputably their own, we hear that deodorizing by lime forms partof their scheme—as to wbich we take leave to express our belief that their first stated views will be fouud to be quite correct; and that distribution upon the land is to be tried, if a company can be got to undertake it, *fiat experimentum in corpore vili:* but may it not be, that distribution upon the land, which might have answered well in all respects, if the works had been *ab origine*, laid down with that view, and organised on a suitable *scale for that end*, will prove a partial or even an utter failure, wben tacked on as an after thought upon a scheme designed upon principles wholly opposite. The Select Committee on the Sewage of Towns bas just concluded its inquiries, and the report may be soon expected. The following is a summarized analysis of the evidence, which bears directly upou the remarks just made. As regards the value of town sewage, in reference to its ingredients, as compared with other manures, liquid aud solid, the evidence proves that it contains the elements of every crop that is grown; it does not lose anything by evaporation; it comes into immediate actiou on tbe crop, and possesses an amount of heat which stimulates vegetation, and even its water is of great benefit for agricultural purposes. The Belgians consider the excretion of each person worth more than 1*l.* per ton per annum. Tbe sewage permanently improves the land, and has been applied, most economically by hose andjet, with great advantage to common grass, Italian rye grass, to roots, and to grain crops. The grass so stimulated is grateful to cattle, improves their constitution, and increases the quantity and richuess of the milk of cows, as the earth not only absorbs, but also deodorizes it, if it be uot applied

in too large quantities. Indeed, to be profitably used it must be applied in slight dressings, and so employed it will supersede the use of guano and artificial manures. It may be applied at any time of the year, except during hard frosts, to every description of soil which is naturally or artificially drained; and the most profitable returns, as in the case of all other manures, will be obtained when it is applied to the best soil. There are in it matters of themselves injurious to vegetation, but they bear so small a proportion to the entire bulk as to be perfectly harmless. If applied as recommended—*i.e*, in slight dressings—no nuisance would be created by its use, the earth, as has been said, deodorizing it; but it cannot with profit be manufactured into a solid manure.

STEAM FIRE ENGINES.

Public attention having been for some time past called to Steam Fire Engines, the following notes on the subject may, perhaps, have some interest for our readers. That America should have taken the lead in this branch of engineering is not remarkable, when we consider that many American towns are built in great part of wood, as the cheapest and most accessible material for building purposes. A conflagration in such a town is of far more serious consequence than in the Old World: hence the necessity of a very powerful supply of water at the very commencement of a fire. This might, it would seem, be as well supplied by many small engines as by a few large ones; but the fireman has given the preference to the latter, and so it comes that we have now large hand engines, worked by 45 men, able to throw, when working at their highest speed, nearly a ton of water per minute, and steam fire engines throwing out nearly two tons per minute—not to speak of the largest



floating steam fire engine here in London, which throws as much as 13½ tons of water per minute, and which did such excellent service at the late great fire in Tooley Street.

But when comparing hand and steam labour, we have in this, as in so many other instances, a most decided advantage in favour of steam in point of economy. It is then only a question whether this advantage, however large it may be, counterbalances possible disadvantages, as for instance, cost of repairs; and this point has not yet, in all instances, received the attention it deserves.

The first American steam fire engine seems to have been made in Cincinnati, about 1852; it weighed 9 tons, and did, notwithstanding its enormous weight, so good service that the town soon depended upon steam fire engines alone for protection against fire. None were self-propelling. Philadelphia and New York soon followed in the track of Cincinnati. Messrs Lee & Larned, Novelty Works, Philadelphia, were early in the field; some of their first engines were self-propelling, had rotary pumps, and threw as much as 5 tons of water per minute. The largest engine had two cylinders of 7½ in. diameter by 14 in. stroke; it was with 150 lbs. pressure and 240 revolutions per minute that it threw this enormous quantity of water through an 1⅝ in. nozzle 160 feet high. Only ten minutes after lighting the fire the engine was able to make a very effectual start. The engine weighed 5½ tons and was self-propelling. The boiler was of the annular tubular construction still retained by these makers. A little later came Baltimore. Here we may mention some public trials which took place in 1858. Before that time none appear to have been very successful, as they cost a great deal in repairs, although they did excellent service when in perfect order. Too much stress seems to have been laid upon getting up steam in an exceedingly short time, hitherto unprecedented in steam engineering. While the success in this respect was startling, the most serious drawback was their constant getting out of order—now the boiler tubes burning out, and leakages—now the breaking down of parts of the engine when travelling over bad roads; the arrangement of the valves, also, often caused serious trouble on account of the high speed they were working at; in consequence of which rotary pumps now and then were employed, and have kept their place in the foremost ranks till the present time. In September, 1858, then, at Philadelphia, we hear of something like success. The engines tried were

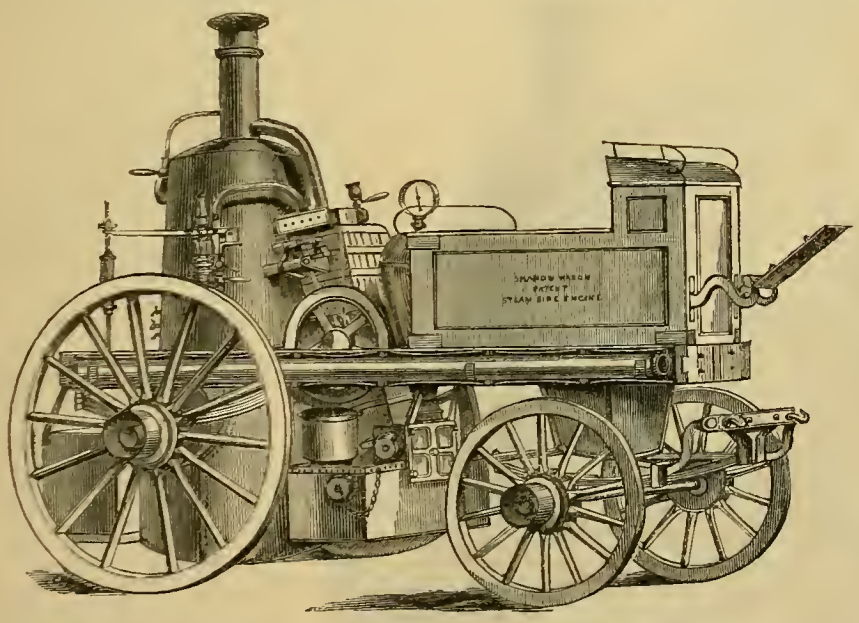
(1.) One, the "Southwark," from Lee & Larned, Philadelphia, with two cylinders 7½ in. diameter by 14 ft. stroke, driving a rotary pump of 17 in. diameter by 10 in. width. It was self-propelling, and weighed rather more than 4 tons. It throws a horizontal stream 145 feet through an 1½ in. nozzle, with a pressure of 40 lbs.; pressure at starting

was 176 lbs.; the previous day, however, it threw a stream 240 ft. through an 1½ in. nozzle.

(2.) Three engines from Rennie & Neapie, Philadelphia, all on the same construction, namely, (*a.*) the "Good Intent," 8 in. cylinder by 12 in. stroke, pump 4⅜ inch diameter by 12 in. stroke, weight 4 tons 8 cwt.; it threw a vertical stream of 169 feet and a horizontal stream of 145 feet through an 1 in. nozzle; 14 minutes 20 seconds in getting steam up, had in 20 minutes a pressure of 90 lbs. (*b*), The "Mechanic," 8 in. cylinder by 16 in. stroke, pump 4⅜ in. diameter by 16 in. stroke, weight 2 tons 11 cwt.; 13 minutes 20 seconds after lighting the fire it started with 55 lbs., 10 minutes later it had 105 lbs. It threw a horizontal stream of 203 feet, and a vertical of 167 feet, through an 1 inch nozzle. (*c*), The "Hibernia," 11¼ in. cylinder by 14 in. stroke, pump 6½ in. diameter by 14 in. stroke, weight 3 tons 11 cwt.; 12 minutes 21 seconds after lighting the fire it started with 55 lbs. pressure, 5 minutes later it had 105 lbs. It threw a horizontal stream of 254 feet, and a vertical do. of 181 feet, through a nozzle of 1⅝ in. diameter.

(3.) One, the "Weecacoe," from Merrick & Sons, Philadelphia, cylinder 8½ in. diameter by 14 in. stroke, pump 6 in. 14 in. stroke; 15 minutes after lighting the fire it started with 50 lbs. pressure, ten minutes later it had 100 lbs. It threw a horizontal stream 109 feet, and a vertical stream of 83 feet through an 1¼ in. nozzle.

(4.) Two from Poole & Hunt, Baltimore. (*a*,) The "Washington," 12½ in. cylinder by 12 in. stroke, pump 6¾ in. by 12 in., weigbt 1 ton 12 cwt.; 18 minutes 20 seconds after lighting the fire, it started with 85 lbs., 10 minutes later it had 80 lbs. It threw a horizontal stream of 239 feet, and a vertical stream of 178 feet, through an 1¼ in. nozzle. (*b*,) "No. 7, Baltimore," 14 in. cylinder by 12 in. stroke, pump 4½ in. diameter by 12 in. stroke, weight nearly 2 tons 9 cwt.; 11 minutes from lighting the fire



it started with 50 lbs., 10 minutes later 100 lbs. It threw a horizontal stream 130 feet 9 in. through an 1 in. nozzle. At another longer trial it threw, with a pressure decreasing from 100 lbs. to 45 lbs. in 20 min., a stream of 196 feet horizontally, and 166 feet vertically, through an 1 in. nozzle.

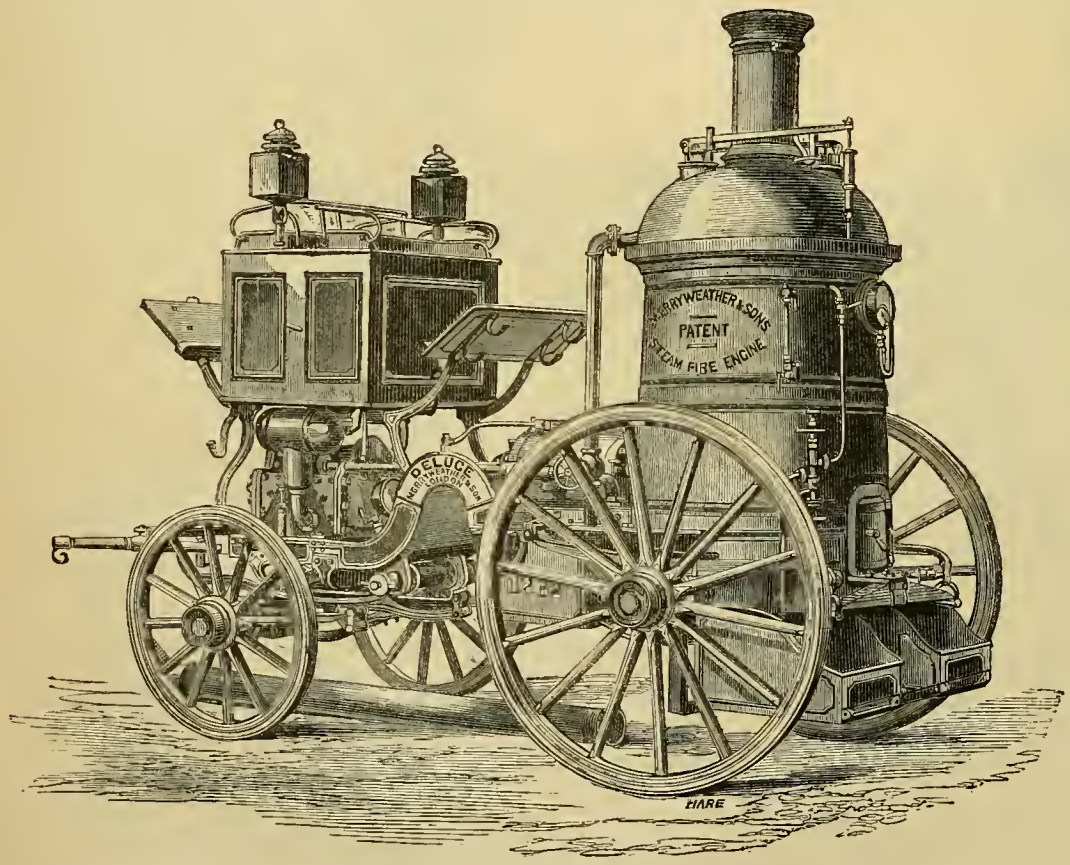
The "Hibernia" had a boiler similar to the one in Merryweather's Deluge, but the copper tubes were afterwards superseded by iron ones.

While America was gaining experience in this branch of engineering, England was also aware of the immense advantage resulting from employing such powerful aid as steam had proved, in so many instances, to fire engines; and London being the greatest centre of commerce and wealth, formed the best field for experiment; but the circumstance of the most valuable property being concentrated on each side of the river, and in the various docks, caused these experiments to take at first a somewhat different direction. While the Americans devoted their attention entirely to steam fire engines for use on land, the London Fire Brigade commenced with steam fire engines for river use. In 1852, Messrs Shand & Mason, whose names have since become identified with steam fire engines in England, applied steam power to one of the hand-worked floating fire engines of the London Fire Brigade. The advantages derived from this proceeding became so manifest, that the directors caused an entirely new floating steam fire engine to be constructed. This was designed and made by the same engineers, and has at various large fires done excellent service. It is generally moored near Southwark Bridge, and had a hard trial at the great fire in Tooley Street, having had to work for nearly three weeks continually. Reckoning its average performance to be ten tons of water per minute, it would give 600 per hour, 14,000 per day, and 288,000 tons of water altogether, a truly astonishing performance. The floats have locomotive boilers and direct acting engines and pumps. To propel the vessel the same cylinders are used; when the ordinary pumps are disconnected, and the steam cylinders are set to work a powerful centrifugal pump instead. The water discharged from the same, by being driven out through two 10 in. openings at stern or stem, propels the vessel either forwards or backwards. Strangely enough, the first land steam fire engine by Shand & Mason was for a foreign government—the Russian. Russia, however, has ample reason for employing very powerful fire engines, owing to the circumstance that wood is employed to a large extent in that country for building purposes, thus rendering a conflagration a very serious affair. The amount of damage done by fires there, especially in some large towns, is indeed something fearful. But then, on the other hand, perhaps nowhere in the world is such an amount of valuable and combustible material collected in one place as here, in the immense docks and warehouses of the metropolis, and other large British depots of the commerce of the world. This fire engine was made in 1858, and was a very creditable beginning. It did nearly as much work as two of the largest size hand engines, in throwing two streams 1-8 in. each to the same height as the hand engines. The boiler was upright, fitted with brass tubes, and was placed over the centre of the hind axle, whilst engine and pump hung on the fore axle. By the use of springs, it was enabled to travel over rough roads. The first land steam fire engine made for the London Fire Brigade was in 1860. Only ten minutes elapsed between lighting the fire and the commencement of playing. The weight was not quite 3 tons; one vertical cylinder, 8½ in. diameter by 6 in. stroke; two pumps, 6 in. diameter by 6 in. stroke. The boiler had a copper fire box, was 3 ft. 4 in. diameter, and had 199 brass tubes 1¼ in. diameter, 15 in. long. It threw an inch stream 130 ft. high. After 10½ minutes from lighting the fire it started with 30 lbs. pressure. In 1861 the same firm made another engine for the London Fire Establishment, which, although of the same weight and bulk, did considerably more work. It got up steam of 30 lbs. from cold water in 12¾ minutes, 70 lbs. 2¾ minutes later, and threw, when worked at its highest speed, 440 gallons of water per minute, the jet being 1¼ in. diameter, and 160 feet high, and at another trial 202 feet horizontally. Comparing this result with the former, a very material progress is to be observed. In the beginning of the present year, a similar engine was procured by the London Fire Brigade, fitted with several improvements which practice had rendered desirable. At the end of last June, Shand & Mason supplied the London Fire Brigade with an entirely new description of engine, their patent, which has given very general satisfaction, and a general idea of which may be formed from the accompanying wood cut. The object the patentees had in view in designing this engine, was to furnish a light and compact machine, carrying hose, suction pipes, and firemen, easily drawn by two horses, not liable to get out of order, and at about one half of the cost of the steam fire engines previously in use. This engine throws one jet 1 inch in diameter 160 feet high, and was worked about eight hours continuously in Hyde Park before the jury, class 8, of the International Exhibition on the 1st of July last, when it was much admired. Shand & Mason have also constructed three engines of the same size as the largest of the London Fire Brigade, for the London and North-Western Railway. These engines do three times the amount of work of the largest size hand engines when worked at their utmost speed, viz., 60 strokes per minute. The common rate is, however, seldom more than 40 strokes per minute, which is quite hard enough work for the men.

From statistics drawn up by Captain Shaw, of the London Fire Brigade, it is found in practice that for every shilling expended, the hand-worked engines throw not quite a ton of water, and the steam fire engines 54 tons. From 25th April to 16th October last year, one of the Brigade steam fire engines worked at 15 fires, the average time of working at each being six hours continuously; and the engine was always found in good working order.

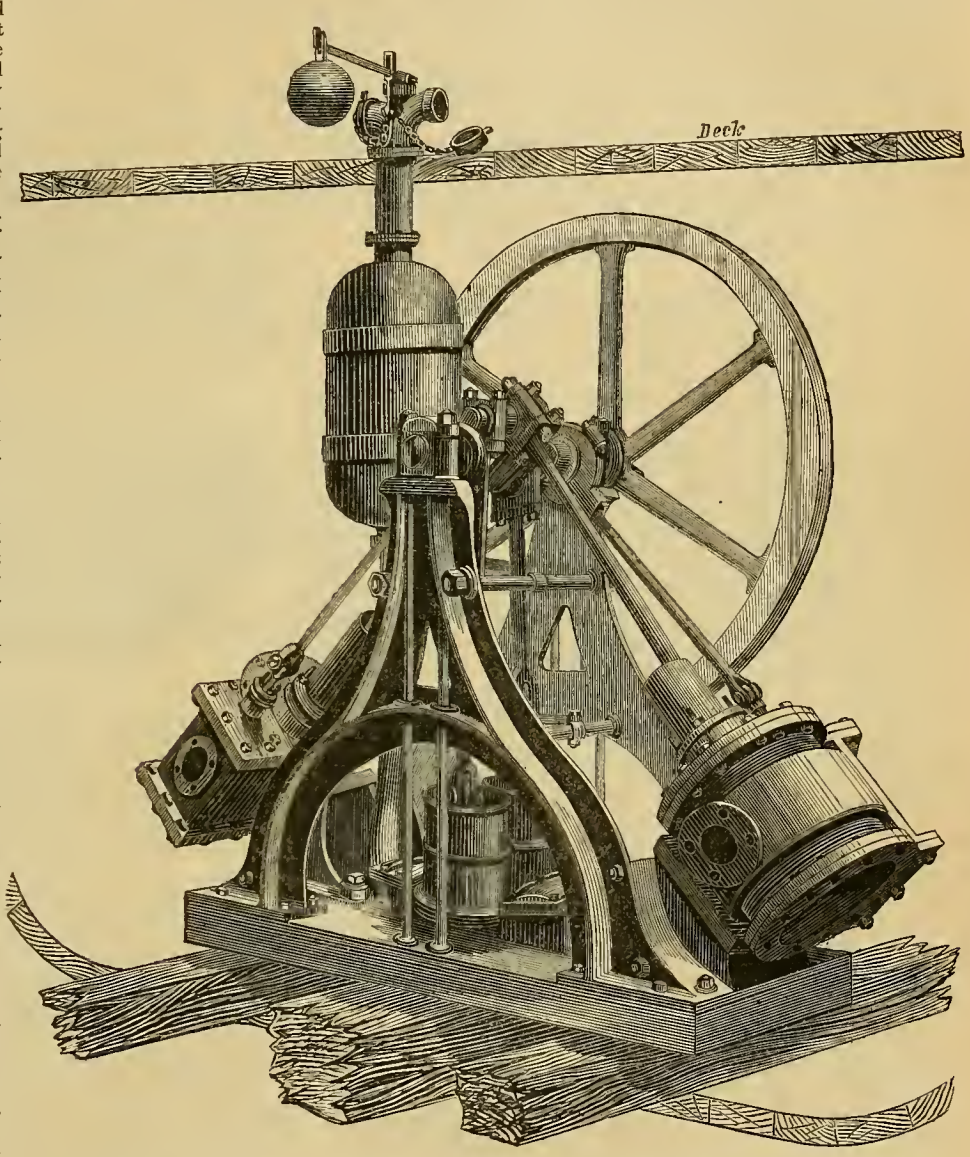
At the commencement of this year, Mr Lee, of the Novelty Works, Philadelphia, brought a sample of his smallest Steam Fire Engine over

to this country, and it is now to be seen at the International Exhibition. It is of a construction frequently and successfully used by Messrs Lee & Larned, and has excited well deserved admiration amongst the few engineers who have seen it at work. It was tried several times at Mr Hodge's distillery, Lambeth, and the light, elegant, and at the same time strong construction, gave the impression that neither mechanical skill nor money had been spared in its design and execution. One remarkable feature in this engine is that with the exception of the boiler tubes, which are of wrought iron, all other parts usually made of this material are here formed of steel of the best brand. If it were not for this, which seems to be the right thing in an engine of this sort, and which we think English makers of Steam Fire Engines will do well to imitate, it would be impossible to construct a powerful serviceable engine of such a small weight. The engine itself (but here it must be noticed that it does not carry any water tank or coal boxes,) weighs only 1 ton 12 cwts. The cylinder is 7 in. diameter, by 7.72 in. stroke, piston rod, 1¼ in. diameter, crank-shaft, 1⅞ in. in bearing, the boiler is only 4 ft. high, and 26 in. outside diameter at the steam chest. It is said to throw 320 gallons of water per minute, 150 ft. high, through an 1⅛ in. nozzle. At a trial at Mr Hodge's distillery the following results were obtained:—Steam was raised 3½ minutes after lighting the fire, in 7½ minutes time from lighting the engine was started slowly by 5 lbs. pressure; in 15½ minutes the engine was working with 135 lbs., throwing 1⅛ in. jet 150 ft. high; afterwards two 1 in. jets 120 ft. high. It threw 1 in. jet 200 ft. horizontally. The engine worked very smoothly indeed, and notwithstanding the very high speed of 300 or 400 revolutions per minute, scarcely any vibration was visible. The pump, fastened to the bottom of the cylinder, forming in fact one of its covers, is rotatory, the crank-shaft going right through it; the boiler is of a somewhat similar construction as "Prosser's boiler," and consists of an upper steam chest (double riveted ¼ in. sheet plates,) with flat top and bottom resting on tubes fastened to the bottom of the same; these tubes encircle the whole of the interior of the boiler, and are below fastened into an annular water space, on which the fire bars rest. Some distance over the grate an inner flat hollow chamber is suspended by tubes fastened to the bottom of the same, and into the top of the steam chest. Round each of these tubes, which convey the products of combustion to the chimney, another tube is placed with a very narrow (⅝ in. or ⅜ in.) water space between. The lower ends of these tubes are fixed in the top of the flat hollow chamber, whilst their upper ends are fastened into the bottom of the steam chest. It will be understood then that the whole space between the grate and the steam chest is enclosed by a circular row of tubes, round which there is a sheeting of thin plate to fill up the interstices between these tubes, and make the lower part of the boiler of the same diameter, and flush with the steam chest. The whole boiler is enclosed and lagged with felt and wood. The water space in this boiler is very minutely subdivided, and the construction is very strong and light, but however ingenious and efficient, it must obviously be rather expensive. It is fed by an injector. The arrangement of the carriage springs is very beautiful, and the engine will stand any amount of jostling without any strain being thrown on the engine proper Boiler, cylinder, and pump are all fastened to a common light and strong bed plate of steel; the boiler is behind the hind axle. A larger steam fire engine of a different construction is now being made for Mr Lee by Messrs Easton, Amos & Co. The arrangment is known as "Worthington's Duplex," and is much used in America for pumping engines. It consists of two cylinders driving two double acting pumps directly without any intervention of fly-wheel, connecting-rod, or crank-shaft. The valves of each cylinder are worked by the piston-rod of the adjoining cylinder; the exhaust steam is properly cushioned so as to stop the piston at the end of its stroke till new steam is admitted to drive it back again. This arrangement is said to work very smoothly and well, and it certainly possesses recommendable features. We hope this engine will have arrangements for carrying its own fuel and water, and that it will afford accommodation for 3 or 4 men, so as to be quite independent of other assistance, and be able to begin work at once on its arrival at the scene of action.



We come now to the trial of steam fire engines at Hyde Park a short time ago. Great expectations were entertained; but owing to a series of accidents to the engines of contending makers, these were not realized, and we must look forward to some future trial for more reliable and instructive results. It is very much to be regretted that Mr Lee, owing to some matter of form, did not appear with his handsome and efficient engine now at the Exhibition. Messrs Shand and Mason had two engines at the trial, one of the common Brigade steamers, (the establishment has two, and two more are ordered,) with a horizontal cylinder 8½ in. diameter by 9 in. stroke, driving directly by means of a slot crank a double acting pump of 7 in. diameter, and of course the same stroke as the cylinder. The boiler is multitubular, but is not built for the purpose of getting up steam quickly, as a gas jet is kept constantly burning in the fire box so as just to keep steam up; a few minutes after lighting the fire the engine is able to work. On this occasion, however, steam was got up from cold water in the usual way. The same firm also had a small engine of another construction at the trial, weighing 1¾ tons wheu empty; two nearly vertical cylinders, 6⅝ in. diameter by 8 in. stroke, work two single acting pumps of 5 in. diameter by the slot crank arrangment. The boiler is substantially nothing but an outer slightly-coned cylinder, with an inner and conical fire box, without any tubes whatever. There is a feed water heater round the chimney, and placed in the steam chamber. This may be effectual enough as a feed water heater; but this arrangment being, in fact, a surface condenser, it is a question whether it does not do more harm than good. Then there was the first land steam fire engine, built by Messrs Merryweather & Son, of Long Acre, London, and which

was designed by Mr Edward Field, and is now in the International Exhibition. They had previously made floating steam fire engines designed by the same engineer, and had succeeded in producing a very compact and well arranged style of engine. The land engine weighs 3¼ tons; it is mounted on high wheels and springs, and is easily drawn by two horses. It is of an entirely different construction from the floating engine. The boiler is made of thin steel plates, and has an inner cylindrical fire box leaving a small space all round. From the top of this inner fire box, a number of copper tubes closed at their lower ends are suspended, having each a smaller tube inside reaching nearly down to the bottom, and projecting slightly above the tube plate. By this arrangement an excellent circulation of steam and water is obtained. From the fire box the products of combustion ascend to the chimney through short iron tubes, fastened to the top of the fire box and the top of the steam chest above the same. The distribution of the tubes prevents any bad effects from unequal expansion of the different parts of the boiler, and no priming is possible even if the boiler is filled with water almost to the upper tube plate; any deposit taking place will accumulate in the outer water place, from which it is easily removed, thus preventing the tubes and tube plates from being burnt. The steam engine consists of a direct acting cylinder, 9 inch diameter by 15 inch stroke, working a double acting pump 6½ inch diameter, without any intermediate gear of crank, fly-wheel, connecting-rod, or shaft; the steam valves are of the piston equilibrium construction, and for some part of their travel are worked by a rod connected with the piston-rod, the remainder of the stroke being completed by a spiral spring. The pump valves are underneath the pump, and so arranged that in pumping foul water, grit cannot injure the pump cylinder, and that no water can remain in the passages when standing, thus preventing any accident by the freezing of the water. The valves and passages are large, and easy to get at. The engine and boiler are fixed to a wrought iron frame forming the carriage, and the frame works on a pivot over the fore carriage, and will stand travelling on very rough roads. The boiler is a very quick steam producer, only 7½ minutes being required to raise steam of 5 lbs. pressure from cold water. In 11½ minutes there was 100 lbs. pressure driving an 1½ in. jet, long before the other two engines had commenced working.



On former occasions, Messrs Merryweather & Son have obtained the following results from this engine:—

With an 1½ in. nozzle	...	150 feet high	...	166 feet horizontal.
" 1⅜ "	...	157 "	...	202 "
" 1¼ "	...	170 "	...	215 "
With two 1 in. nozzles	...	150 "	...	180 "

The above measurements are of the performance of this engine, kindly permitted by Mr Frederick Hodges, at his distillery in Lambeth, on the 24th of May last; when working perpendicularly, the jet was projected by the side of the lofty chimney shaft 140 feet high, so that the total height of the jets could be accurately taken. In another experiment previously made, water was drawn up perpendicularly 14 feet from the Thames, and then discharged through an 1¼ inch nozzle clear over a building 60 feet high, to a horizontal distance of 210 feet. The quantity of water discharged is from 450 to 500 gallons per minute.

We understand that Messrs Merryweather & Son are now building steam fire engines of a lighter construction.

At the Hyde Park display, Shand & Mason's large engine commenced working 18 minutes after lighting the fire, and had 100 lbs. in 24 minutes. Instead of measuring the water delivered by noting the amount of water *drawn* in a certain time from measured graduated tanks, or by water meters, which seems to us a far more correct way of comparison, the jets were directed against large canvas hoods, leading the water into measuring tanks; it was impossible, on account of the occasionally large amount of spray, to get at anything like correct results. The small engine had somehow got its chimney choked with wood, and was not able to resume work for an hour. It did, however, afterwards, good service, considering its size. There was no end of accidents to all of the engines;—now the gauge glasses burst—now the hose of the small engine. The nut fastening the piston to its rod on Merryweathers' engine got loose, but fortunately did not knock out the bottom of the cylinder, this construction of engine being secured against that kind of accident. Shand & Mason's large engine got its suction pipe stopped by a bit of waste for some time. Altogether the results were not, on account of these and other reasons already stated, such as would afford sound data for forming a fair comparison of the different engines.

The floating steam fire engines, built by Messrs Merryweather & Son for service on the river Tyne, for the protection of the various docks, wharves, &c., in and around Newcastle, are fixed in the tug-boats plying on that river. This method of fixing steam fire engines in tug-boats is very advantageous, as beyond the first cost of the engine very little after expense is incurred. These engines are fixed in the fore part of the vessel, and supplied from the usual boilers. The tug always having steam up ready for shipping emergencies, entails no further expense than usual for fuel or attendance, and is always ready at a moment's

notice. One of these engines was made for the North-Eastern Railway Company, by order of John Bourne, Esq , their engineer.

The following is a brief description of these engines, shown in perspective elevation, p. 155.—Each engine is mounted on a base plate, occupying a space of 8 ft. by 2 ft. 6 in. On the base plate are fixed two inclined steam cylinders, each 16 in. diameter with 12 in. stroke, on the trunk principle, working on to one crank shaft at the apex of an A shaped frame. Immediately beneath the crank shaft, and worked by it, is the fire engine, consisting of two 9-inch single-acting pumps, with 10 inch strokes; the valves, pumps, and valve boxes are of gun metal; covers are provided for easy access to the valves. The engine is surmounted by a capacious copper air vessel, with two delivery outlets for attaching hoses, and provided with an escape valve. A steady, constant stream of water is delivered by this class of engine at the ordinary speed of working. The following is the result of some experiments:—

No. and Size of Jets.	Steam Pressure in lbs. per square in.	No. of revolutions per minute.	Water Pressure in lbs. per square in.	Distance to which Jet is delivered.
1—1⅛	13	60	60	163 feet.
1—1¼	13	70	50	138 feet.
2— ⅞	17	70	60	150 feet.

Comparing the results of late date with former ones, we arrive at some idea of the progress in this department of engineering. It is an interesting and important field, full of difficulties, but there is no question that steam, at least in all the large towns, will ultimately supersede hand engines, and this not only on account of its enormous power, but also its cheapness. It costs about a halfpenny to supply a ton of water by steam from a steam fire engine as now made, whereas with hand labour it costs more than three times that sum per ton, as stated by Captain Shaw, on data obtained from experiments made with land and floating steam fire engines. By the courtesy of this gentleman, we are able to give the subjoined highly interesting list of the performance of the Fire Brigade engines. We hope that ere long steam will here supersede hand labour, as it has done in so many other instances, to the mutual benefit of the public and the insurance companies. The spirited way the latter have taken the matter in hand, being in fact the main protectors against fire, not only for the non-insuring as for the insuring public, shows that they understand the requirements of the age, and that they know how to serve at the same time both the public and their own interest.

Particulars of Hand-worked Fire Engines, with two single-acting pumps, working at an 8 inch stroke:—

Dia. of Pump	Content in Cubic Inch.	Gallons Delivered in Strokes per minute. 30	40	60	Size of Jets in 1-16th of Inch.	No. of Men.	Length of handle on each side.
3 in.	113	12.2	16.2	21.4	5 and 6	4	2 ft. 6 in.
4 in.	201	21.7	29	43.4	7 and 8	8	6 ft. 9 in.
5 in.	314	34	45	68	9 and 10	14	9 ft.
6 in.	452	49	65	98	11 and 12	20	13 ft.
7 in.	614	67	88	134	13 and 14	28	17 ft.
8 in.	804	87	116	174	15 and 16	36	23 ft.
9 in.	1017	109	145	218	17 and 18	45	29 ft. 3 in.

Particulars of Steam Fire Engines:—

Dia. of Pump.	Stroke.	Cubic content in Inch.	Gallons Delivered at Strokes per Minute. 60	100	150	Size of Jets.
7 inch.	9 inch.	693	150.75= ¾ tons.	251.25= 1⅛ tons.	376.87= 1¾ tons.	2 of 1 in. 1 of 1⅜ in., & 1 of 1¼ in.

Particulars of Lower Float, having 4 single acting pumps:—

9 inch.	12 in.	3051	654 = 3 tons.	1090 = 4⅞ tons.	1635 = 7¼ tons.	2 of 1½ in.

Particulars of Upper Float, having 2 double acting pumps:—

10 in.	18 in.	5654.8	1223 = 5½ tons.	2040 = 9 tons.	3060 = 13½ tons.	4 of 1½ in.

RECENT PATENTS.

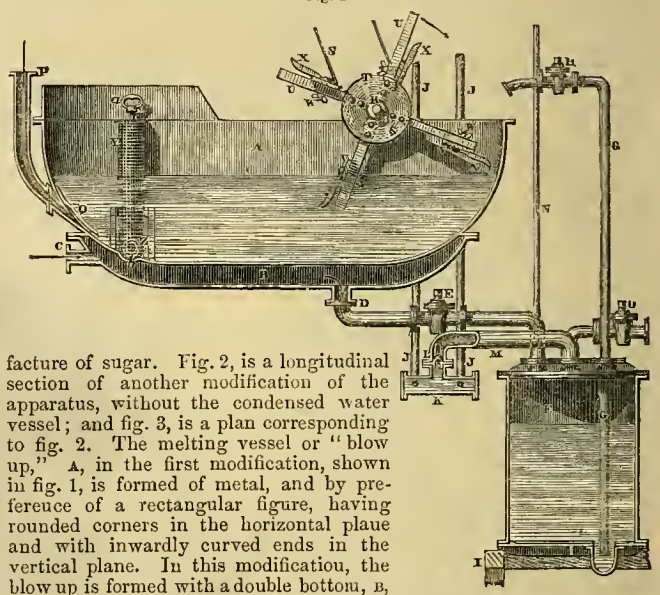
SUGAR MANUFACTURE—MELTING APPARATUS.

William Orr.—*Patent dated January* 27, 1862.

This invention relates to the arrangement and construction of the apparatus used in the manufacture of sugar for melting the sugar, which operation is technically known as "blowing up." Under one modification of the apparatus, it consists of an open vessel, by preference of a rectangular or circular figure about twelve feet by five, and four feet deep. This rectangular vessel is made with curved ends extending to the bottom, which gives to it a boat-like figure in its longitudinal section. The construction and general arrangement of this modification is shown and described in reference to fig. 1 of the subjoined engravings.

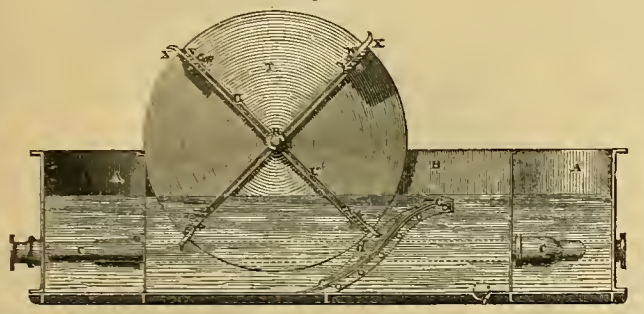
Fig. 1 of the accompanying engravings, is a longitudinal vertical section of one modification of this improved apparatus for the manufacture of sugar. Fig. 2, is a longitudinal section of another modification of the apparatus, without the condensed water vessel; and fig. 3, is a plan corresponding to fig. 2. The melting vessel or "blow up," A, in the first modification, shown in fig. 1, is formed of metal, and by preference of a rectangular figure, having rounded corners in the horizontal plane and with inwardly curved ends in the vertical plane. In this modification, the blow up is formed with a double bottom, B, for the admission of steam to heat the contents of the vessel; this false bottom is bolted to a flange projecting laterally from the lower part of the melting vessel, A. The steam is conveyed into the chamber thus formed through the pipe, C, whilst the water of condensation flows away by the pipe, D, which is fitted with a cock, E, into the receiver, F. This receiver is a closed cylindrical vessel, which acts also as a receiver for the water of condensation flowing from the other melting vessels throughout the works. By means of the cock, E, the steam may at any time be caused to act upon the surface of the water in the vessel, A, and so force the water contained therein up through the vertical pipe, G, which extends over the edge of the blow up, A, and is furnished with a cock, H, to regulate the flow. The lower end of the pipe, G, dips into a small well extending below the bottom of the receiver, this vessel is placed on a suitable framing or stand, I, to bring it within a convenient distance of the blow up, A. The water of condensation from the steam heating pipes throughout the works, and from the other melting vessels, is carried from the upper part of the sugar refinery by the pipes, J, into the T shaped pipe, K, which is fitted with a float or other suitable valve, L, bolted to the inlet pipe, M, or in some cases direct into the receiver by the branch pipes, *d*, in the cover as in the case of the present melting vessel, A. Should an excess of water accumulate in the receiver, F, it escapes up the open pipe, N, which is purposely made of small diameter; the escape of the water at the upper part of this pipe warns the attendant to open the cock in the outlet pipe, O, and allow the surplus water or steam to flow off. The arrangement of the ball valve, L, in the inlet pipe, M, readily admits any water of condensation that may flow down the pipes, J, into the receiver, F, but prevents any escape either of water or steam in that direction. Steam is also admitted to the interior of the melting vessel, A, by means of the steam pipe, P, which is flattened out at the lower part, and enters the blow up, just above the steam pipe, C. The opening of the steam pipe, P, is covered by a fixed deflecting plate, Q, which serves to direct the steam to the lower part of the blow up, and cause a current in the liquid contents, by its impinging on the curved

Fig. 1



boat-like surface of the lower part of the melting vessel. On the marginal flanges of the blow up, A, are fitted the bearings of the transverse horizontal shaft, B, on the overhanging extremity of which is arranged the fast and loose pulley, S, which is driven from a contiguous steam

Fig 2.



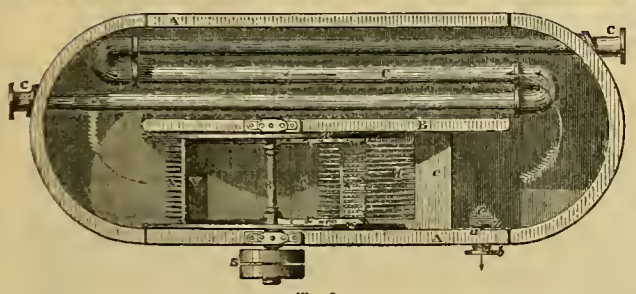


Fig. 3.

engine or other prime mover. This shaft has keyed to it two discs, T, to which are bolted the radial arms, U, and to these arms the float boards, V, are attached by means of the clips and thumb screws, W, or other equivalent contrivance. This arrangement of the float boards, V, admits of their being readily adjusted at different part of the supporting arms, and it is preferred to have them arranged at varying distances from the axis, as shown in fig. 1, in order that they may act at different depths on the sugar contained in the blow up. To the face of each float board is screwed a number of knives or cutters, X, which extend out beyond the margin of the board. When the machine is put in motion, these cutters as they come into contact with the solid lumps of raw sugar divide them rapidly, at the same time the float boards cause the whole of the liquor to be put into rapid motion, so that the entire body of the saccharine liquor is carried round in a continuous stream, and subjected to the dividing action of the cutters. When but a comparatively small quantity of liquor is contained in the blow up, the jet of steam emitted through the pipe, P, serves to put the fluid into circulation, the ascending and descending of the current being assisted by the curvature of the ends of the vessel, A, and so prevents any deposition of the sugar on the bottom. At the side of the blow up, is fitted the vertical wire gauze screen, Y, behind which is arranged the sluice valve, Z; this valve is raised by the handle, *a*, which projects above the screen, Y. The sluice valve, Z, controls the passage of the outlet pipe, *b*, by means of which the contents of the vessel, A, are discharged when required, by raising the handle, *a*, the gauze screen serving to arrest any impurities floating on the surface of the saccharine liquor.

In figs. 2 and 3, another modification is shown in which the heating of the liquor is effected in a different manner. In this arrangement the melting vessel or blow up, A, is a flat bottomed receiver with semicircular ends. This vessel is partially divided in a longitudinal direction by the partition, B, on one side of which is fitted the steam pipe, C. This pipe is arranged in a coil, as shown, or in any other equivalent manner; the steam passing through it in the direction of the arrows. Extending across the other division of the vessel, A, from the outer margin to the partition, B, is the horizontal shaft, E, which corresponds in its office to that shown in the previous modification, and is driven by the pulley, S. The shaft, E, has keyed to it, two large discs, T, which are formed with radial grooves, U, extending from the peripheries to the centres. The float boards, V, are slipped into these grooves and are fastened by spring pins, W, which are passed through holes made for the purpose in the rims of the grooves, U. A series of knives or cutters, X, are screwed to the float boards, V, in a similar manner to those described in the first arrangement. To the bottom and sides of the vessel, A, is fixed a curved frame or bridge piece, *c*, in the open part of which are fixed a number of flat strips of metal, *d*, these metal strips are arranged edgewise, and serve as so many stationary cutters, as the ends of the cutters, X, pass through them. When the shaft, E, is put in motion, the action of the float boards puts the whole of the fluid contained in the vessel, A, into motion, and the undissolved sugar is carried towards the grating, *d*, where the cutters, X, speedily divide it. The saccharine liquor, after being properly heated, is run off by the outlet pipe, *b*, which is arranged like that shown in fig. 1. In this way the melting of the sugar is greatly facilitated, and effected at low temperatures, whilst the waste of heated water or steam is wholly prevented, and the amount of manual labour ordinarily required is much reduced.

CARPET POWER LOOM.

James Platts, *Glasgow.—Patent dated August* 20, 1861.

This invention relates to various improvements in carpet looms generally, but especially, or more particularly, to the arrangement and construction of looms for enabling them to weave Scotch carpets by power, instead of by the hand looms, as heretofore, in this class of woven fabrics.

Figs. 1 and 2 of the subjoined engravings are complete side and back elevations respectively of a power loom constructed according to this invention, for working the double ply Scotch carpet, and with slight modifications, capable of weaving the three ply carpet also, of this class of fabric. Figs. 3, 4, and 5 are elevations and sections of the mechanical details shown detached from the loom for working the shuttle box arrangement, etc. The framing, A, of the loom consists of a pair of open panelled end standards, united by transverse rails, and carrying at the upper part the jacquard mechanism. Outside each of the standards of the main framing is a secondary standard, B, which is connected to the main framing by transverse ties; and in the space between these standards is arranged the principal portion of the mechanical details for actuating the movements of the loom. On the crank shaft, C, is fitted the fast and loose pulley, D, for driving the loom; and on this shaft is keyed the pinion, E, which gears with the wheel, F, on the tappet shaft, G; these wheels are indicated by dotted lines in figure 1, to avoid confusing the other portions of the mechanism. On the further extremity of the tappet shaft, G, is a wheel, H, which gives motion to the wheel, I, on the shaft, J, which extends across the loom parallel with the tappet shaft, G. The details of the parts connected with the shaft, J, for actuating the shuttle boxes in the required sequential order are shown separately in figs. 3, 4, and 5. Fig. 3 is a front elevation, partly in section, of the movement; fig. 4 is an end view taken at right angles to fig. 3; and fig. 5 is an elevation, showing the segmental or crescent wheel, by means of which the main lever for operating the shuttle boxes is partly actuated. The wheel, I, has bolted to its face the segmental wheel or disc, K, which has formed on its face a segmental rib, K^1, as shown in side view in an enlarged scale in fig. 5, and in edge view in figs. 2 and 3. A short horizontal shaft, L, carried in brackets projecting from the standards of the framing, supports a curved lever, M, which extends in a downward direction towards the front part of the loom, the boss of the lever being adjustable on the shaft by means of punching screws. A corresponding arrangement is fitted on the opposite side of the loom, as shown in fig. 2. The lever, M, is cast hollow, leaving a rectangular space between the parts forming the cheek plates; and at one side is a laterally projecting part, which forms a rectangular recess to receive the roller, N, as shown in fig. 3. The spindle on which the roller, N, is fitted, also carries the roller, O, arranged in the central part of the lever, M; this roller, at every alternate shot of weft, is brought into contact with the disc, P, which is arranged on the shaft, J, the action of this disc causing the required pattern shuttle box to be brought in a line with the shed. The free ends of the levers, M, are each connected by the rod, Q, to the adjustable lever, R, which is carried on a small shaft supported in brackets fixed to the standards of the framing. The front end of the lever, R, is connected by the rod and bow piece, S, to the slide, T, forming the back part of the shifting shuttle boxes, which are numbered from 1 to 6 in fig. 1. The lever, R, has an adjustable counterweight, R^1, at the backward end, which serves to counterpoise the weight of the shuttle boxes and parts connected with the lever, and so admit of the shuttle boxes moving easily up and down in accordance with the movements of the pattern mechanism. Four out of the series of six shuttle boxes are appropriated to the variously coloured wefts for producing the predetermined pattern; these are the first, second, fourth, and fifth boxes, whilst the third and sixth boxes supply the binding weft, which is thrown in to bind the coloured yarn. The office of the segmental wheel, K, is to bring the shuttle boxes, number three or six, in a line with the shed, after each shot of coloured weft is thrown in, the one selected being that which is nearest to the last pattern shuttle box in use. Thus, when the roller, N, rests on the rib, K, of the segmental wheel, K, the lever, M, is raised to the position required to bring the third shuttle box in line with the shed; and when the roller, N, is

traversing on the periphery of the segmental wheel, K, the sixth shuttle box comes into use. The means by which this change of position is being alternated with a binding weft from the shuttle box number three, which is brought up to the shed by the intermitted motion of the

Fig. 1.

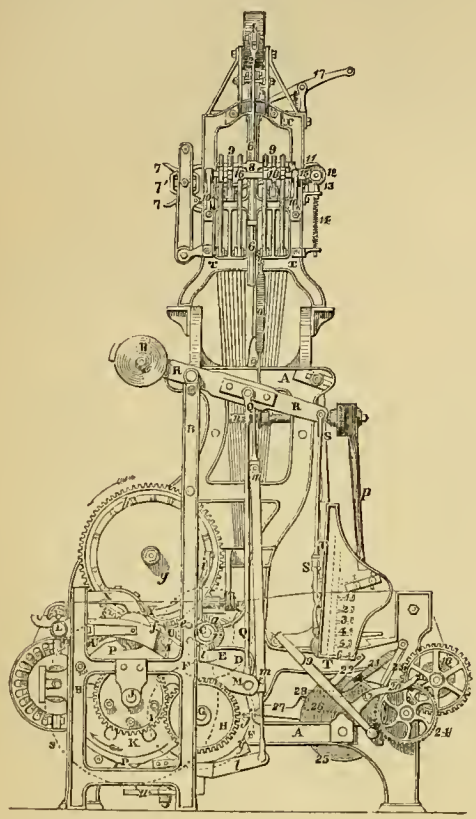
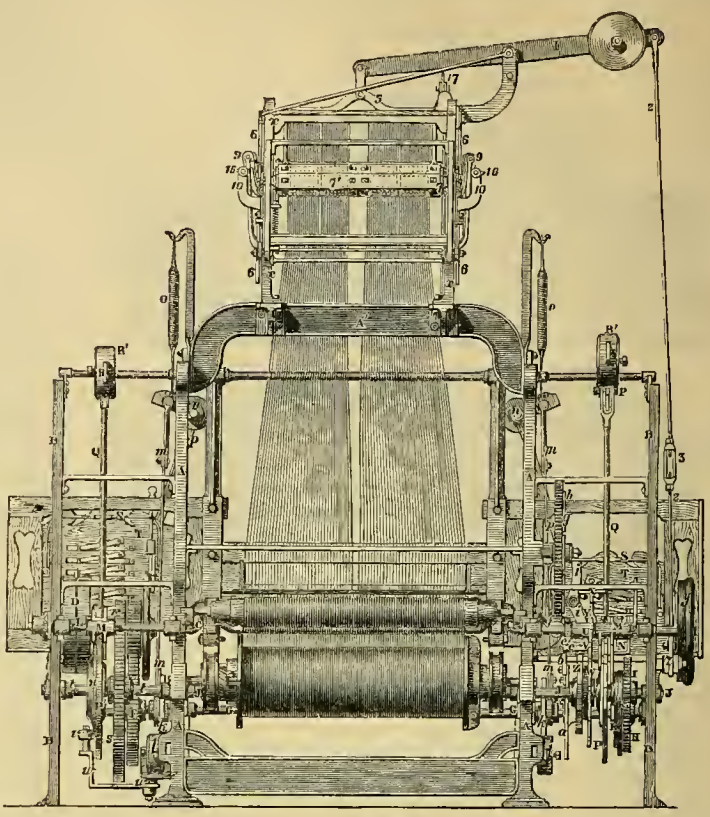


Fig. 2.



effected will be presently referred to. In the intervals of the raising of the lever, M, by the segmental wheel, K, the roller, O, descends on to the periphery of the disc, P. The edge of this disc forms a series of inclined planes, which serve to raise the lever, M, to different heights, and so bring the pattern shuttle boxes to the level of the shed in the required succession. In fig. 4, the disc, P, is shown in side view, and

Fig. 3.

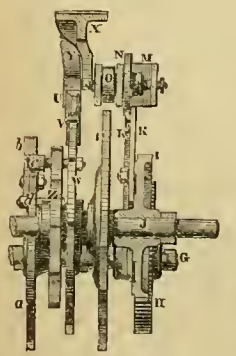
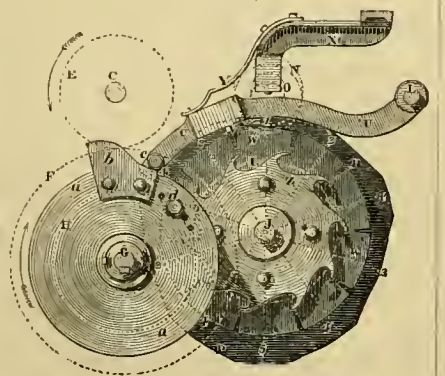


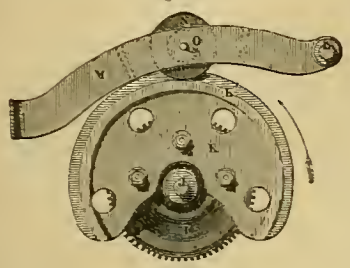
Fig. 4



is divided by ten lines radiating to the centre of each incline; these lines are numbered in accordance with the number of the shuttle box which will be brought into requisition on the corresponding part of the periphery of the disc being brought under the roller, O, in the lever, M. Thus, as delineated in fig. 4, the roller, O, is shown resting on that part of the periphery indicated by the line 1, which raises the lever, M, and actuates the connected parts, so that the shuttle box, number one, is brought in a line with the race of the lathe, and the shuttle contained in that box is driven across the shed. This action of the one shuttle box may be continued as long as required, according to the number of shots of weft of one colour it is necessary to put in, each shot, however, segmental wheel, K^1, acting on the roller, N, as shown in Figs. 3 and 5. The disc, P, is held in a fixed position, so long as may be required, to put in one or more shots of the coloured or pattern weft from any particular box. On the small shaft, L, is a bent arm, U, on the under side of which is a downwardly projecting catch, V, which takes into the radial notches formed in the disc, W, which is fast to the boss to which the disc, P, is bolted. Extending forward from the standard, B, is a bracket piece, X, the end of which is bent in a downward direction, the lower part being bevelled off, and having resting against it the spindle of the rollers, N and O. To the bracket piece is fixed the blade spring, Y, which presses on the back of the arm, U, and keeps the catch, V, down into the notches of the disc, W, when the arm is not otherwise acted upon. Parallel to the disc, W, and on the same boss is a secondary disc, with deep-curved indentations. This disc, Z, and with it the discs, W and P, are moved round at intervals, as the pattern may require, by means of the disc, *a*, which moves to and fro on the tappet shaft, G. On the periphery of the disc, *a*, is bolted a piece which forms an inclined plane, *b*, for lifting the catch, V, out of the notches of the disc, W. As the disc, *a*, rotates, this inclined plane comes under a roller, *c*, which is carried on a stud projecting laterally from the arm, U, the inclined plane raises the arm, U, leaving the disc, W, free to be moved round. In the face of the disc, *a*, several holes are made to admit of the adjustment therein of a stud, *d*, carrying a roller which takes into the curved indentations of the disc, Z. The arm, U, being kept uplifted by the inclined plane, *b*, the continued rotation of the disc, *a*, causes the stud, *d*, to move the disc, Z, round to the extent of a tooth, or until the arm is free of the inclined plane, *b*, when the catch, V, springs into the tooth of the disc, W. The movement of the disc, W, actuates the disc, P, to a corresponding extent, and so brings another of the inclined planes on its periphery under the roller, O, and thus, by altering the lift of the lever, M, and its connected parts, a corresponding change in the position of the pattern shuttle boxes is effected. In this way, by having a series of discs, P, the peripheries of which are differently formed, so as to effect different alternations of the shuttle boxes, any required combination of colours within the range of the pattern shuttles may be obtained, by simply shifting one disc and substituting another. It remains to show in what manner the disc, *a*, is caused to move to and fro on the shaft, G, and so effect the shift of the disc, P, at the proper intervals. On

the extremity of the crank shaft, C, is a bevel wheel, *e*, which gears with a corresponding wheel on the horizontal worm shaft, *f*, the bearings of which are carried in brackets projecting laterally from the framing. The worm on this shaft, *f*, gives motion to the wheel, *g*, which is carried on a stud projecting laterally from a cross rail of the framing. To the face of this wheel the metal segments, *h*, are fixed; these segments are of varying lengths to correspoud to the number of picks required from a given shuttle before a change is effected. Pendent from the cross rail of the framing which carries the wheel, *g*, is a bracket carrying a stud on which the lever, *i*, is centred. The upper extremity is bent at right angles, and rests against the face of the wheel, *g*; the lower part of the lever is prolonged down to the tappit shaft, G, terminating in a fork, which partly encircles, and is connected to the boss of the disc, *a*. To a laterally projecting arm extending from the forked extremity of the lever, *i*, is attached one end of a helical spring, *j*, the other end of which is fastened to the framing; this spring has a constant tendency to draw the disc, *a*, towards the arm, U, and disc, Z—this tendency is, however, counteracted by the lever, *i*. As the wheel, *g*, is driven round by the worm shaft, *f*, the wedge-shaped extremity of the lever, *i*, passes over the projecting segments, *h*, and whilst this continues the disc, *a*, is kept by the forked end of the lever clear of the roller, *c*, and the disc, Z, consequently no change in the position of the disc, P, can take place. In this way the weaving is continued from one shuttle box, alternating with the binding weft, during any required number of picks. The moment, however, that the end of the lever, *i*, enters one of the recesses formed between the segments, *h*, the disc, *a*, is moved towards the disc, Z, and which is assisted by the tension of the spring, *j*, so as to bring the inclined plane, *b*, in the same plane as the roller, *c*, and the roller, *d*, in the plane of the disc, Z. And in this way the shifting of the shuttle boxes is effected as often as required by simply attaching suitable segmental pieces, *h*, to the face of the worm wheel, *g*. The shuttle boxes numbered three and six are selected for the shuttles containing the binding weft, so that the traverse of the drop, T, between the shot of coloured or pattern weft, and the ground or binding weft may be limited, and time saved. Thus when the disc, P, is moved round so as to bring the parts numbered four or five under the roller, O, the lever, M, is raised up so that the bevelled end of the roller spindle is moved up to the face of the bracket, X. This motion of the spindle carries the roller, N, on to the periphery of the segmental wheel, K, so that at each revolution of this wheel the lever, M, is elevated sufficiently to cause the binding weft to be thrown in from the sixth shuttle box; this will be seen more clearly in Fig. 3. The range of traverse from the pattern weft boxes to the binding weft boxes being thus limited to the two boxes above each of the latter. The picking motion is derived from the tappets, *k*, which are fast to the tappet shaft, G; the rotatory movement of the shaft brings the projecting part formed on each side of the tappets in contact with the roller on the weighted treadle levers, *l*. The front ends of these levers are connected by the straps, *m*, to laterally projecting arms on the shafts, *n*; these arms are kept in an elevated position when not otherwise acted upon by means of the helical springs, *o*, each of which is suspended from a hooked support bolted to the framing. The front extremities of the shafts, *n*, terminate in the usual conplings, to which are fitted the picking sticks, *p*. In their rotatory movement the tappets depress the treadles with a quick motion, which turns the shafts, *n*, partly round, and so cause the picking sticks to operate alternately, or otherwise, and drive the shuttle out of the box. Upon the treadles, *l*, being released from the tappets, *k*, they spring upwards by the tension of the springs, *o*, but are prevented from rising too high by the stops, *q*. Provision is also made for throwing in a succession of shots from one side of the loom when this is required. On the crank shaft is a pinion, *r*, which gives motion to the large wheel, *s*, on the shaft, *t*. This shaft is in a line with the shaft, J, but is distinct therefrom; its inner extremity is arranged end to end with the shaft, J, the one bearing serving for both shafts. On the shaft, *t*, is the disc, P^1, which operates the lever, M, for working the shuttle box on that side of the loom; and fastened to the outside of this disc is a ring, *u*, which has screwed to its face projecting segmental pieces, shown more particularly in Fig. 2, which are brought by the rotatory movement of the disc in contact with the roller, *v*. This roller is carried on a stud which forms part of a moveable bracket piece, *w*, centred on a stud pendent from a bracket projecting out from the framing. When the segmental pieces on the ring, *u*, intervene between the roller, *v*, and the ring, the bracket piece, *w*, is moved to that extent about its axis, and this moves the roller aside, so that the rim only of the tappit rotates thereon, and the treadle is consequently not depressed. In this way the picking action is carried on from the opposite side of the loom for as many picks as may be required, according to the length and arrangement of the segmental pieces fixed to the disc, *u*. The jacquard mechanism is arranged on the upper part of the loom framing, the end standards, *x*, of its framing being bolted to brackets fixed to the upper rail or tranverse stays, A^1, of the loom frame. Motion is imparted to the jacquard mechanism from the wheel, *y*, on the extremity of the crank shaft, C; this wheel has a heart shaped groove formed on its inner face, which imparts a vertical reciprocatory movement to the lever, *z*. This lever is centred on a stud projecting laterally from the standard, B, and it has a pin fixed to it which carries the roller, 1; this roller traverses in the groove of the wheel, *y*, the rotatory movement of which causes it to rise and fall. The outer end of the lever, *z*, is connected to the rod, 2, the upper end of which is screwed and united by the screw swivel link, 3, to the rod, 2, above; this rod is attached to the lever, 4, which communicates motion to the jacquard machine. The lever, 4, is connected by a link to the cross head, 5, which is attached to the upper boards, and also to the sliding pieces, 6, which move up and down in guides formed on the standards, *x*, of the framing. The cross head, 5, has attached to it on the inner side of one of the sliding pieces, 6, a vertical rack which gives motion to a segmental wheel which actuates the duplex hooked lever, 7, for drawing round the perforated cylinder, 7^1, over which the endless series of cards is passed. The upward traverse of the slides, 6, lift the catch bars, 8, which form a part of the slides; these bars lift the vertical catches, 9, which are jointed to the lifting boards. The catches, 9, are carried loosely in the upper ends of the supporting rods, and they are caused to catch on the bars, 8, in the sequence required by means of cams formed on the small horizontal shafts, 10. One of the catch bars, 8, has connected to it a liuk, which, in the upward traverse of the bar, causes the pawl, 11, to draw round the wheel, 12. The boss of this wheel forms a ratchet for the pawl, 11, to fall into and draw it round; it has also a squared part against which the small vertical rod, 13, is pressed by the helical spring, 14, so as to hold it firmly whilst the pawl, 11, is inoperative. The bevel wheel, 12, is fast to a horizontal shaft extending across the jacquard machine, and it has at its other end a corresponding wheel. Each of these wheels gears with a bevel wheel, 15, on the shaft, 10, formed with cams, 16, so as to push in the catches, 9, and raise the boards in the order required. Should a false shot be made, or it be requisite to turn the barrel, 7^1, back to any required extent, this is done by means of the lever, 17, which, by means of a cord and handle, is brought down within convenient reach of the operator. The drawing down of this lever draws up the vertical rack, and so turns the barrel, 7^1, in a backward direction. As the cloth is woven it passes round the roller, 18, which is covered with card cloth; this roller is actuated from the lathe by means of a positive take-up motion. On the lathe is a segmental shaped piece of metal, which, at each backward stroke of the lathe, comes in contact with the lever, 19, which is centred on a stud fixed in the side standard. To the laterally projecting arm of this lever is jointed a pawl, 20, the central part of which is open, so that it partly encircles the ratchet wheel, and allows the extremity to fall into the teeth of the wheel. The lever is drawn upwards by the helical spring, 21, but is prevented from springing too high by the stop, 22. The spring, 21, is made fast to the stud on which the ordinary double pawls, 23, are carried. As each shot of weft is thrown in, the lever, 19, is depressed, causing the pawl, 20, to draw the ratchet wheel, 24, round to the extent of a shot, the ratchet wheel being prevented from returning by the pawls, 23. The motion of the ratchet wheel is communicated by means of a pinion on its axis to the wheel, 24, on the spindle of the roller, 18. The cloth is carried from the roller, 18, to the cloth beam, 25; on the spindle of this beam is a ratchet wheel, 26, indicated by dotted lines. The ratchet wheel is actuated by a lever, 27, which is weighted at the backward end, and has jointed to the front part a pawl, 28, made like the pawl 20. A cam on the tappet shaft raises the lever, 27, at each stroke of the loom, and takes up the necessary amount of the ratchet wheel, 26, which is fast to the cloth beam, 25. The arrangement of the weighted lever, 27, allows for the gradually increasing diameter of the cloth beam, as well as to avoid any slackness of the cloth. With these several improvements, the manufacture of two ply or three ply carpeting, and other fabrics, is greatly facilitated, and a consequent saving in expense is effected.

Fig. 5.



SPINNING AND THROSTLE FRAMES.

ALEX. AND JAMES EDWARD.—*Patent dated December* 31, 1861.

THESE improvements have reference to the arrangement and construction of the machinery used more particularly for the purpose of spinning and twisting flax, tow, jute, and other yarns, to be used as weft, or other generally similar purposes. The improvements are also applicable to throstles and doubling frames generally.

Fig. 1, of accompanying engravings, is an end elevation of a portion of a spinning frame, sufficient to show the nature of the improvements.

Fig. 1.

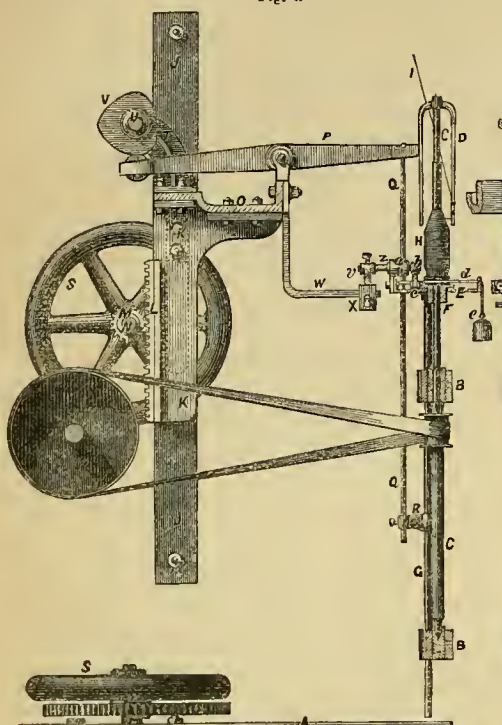


Fig. 2.

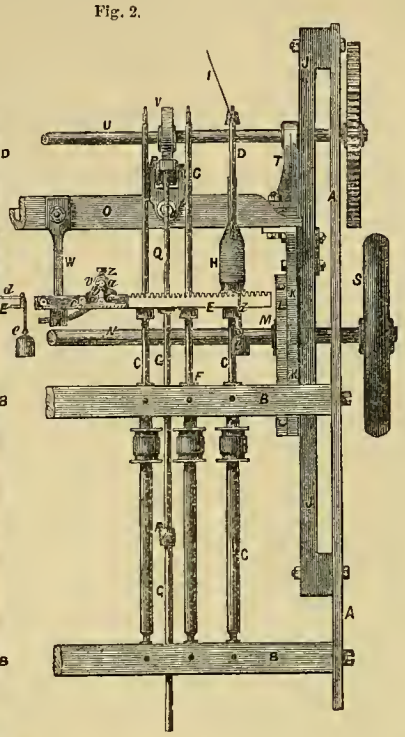


Fig 3.

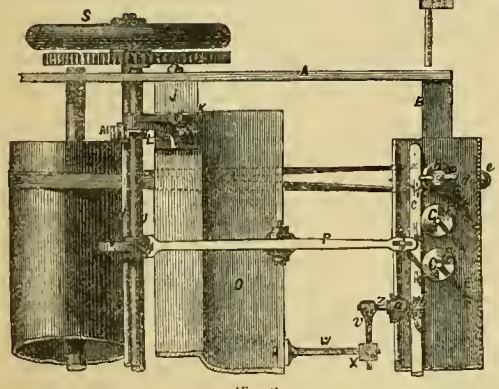


Fig. 2 is a front elevation of the same, corresponding to fig. 1; and fig. 3 is a plan of the same, also corresponding to fig. 1. The framing of the machine consists of the ordinary gables or end standards, A, connected by the longitudinal rails, B. In the lower one of these rails are fitted the footstep bearings of the spindles, C, and in the upper rail are arranged the collar bearings for the same. The spindles, C, are made longer than the ordinary kind, in order to adapt them to the improved arrangement of the other parts of the machinery. To the upper end of each spindle is fitted a flyer, D, the legs of which are also made longer than the ordinary kind. Each spindle passes through the lifter, E, and at this part it is further steadied by means of a collar or neck brass, F, which is screwed into the lifter. These collars, F, are made with flanges at the upper part, as shown in figs. 1 and 3, and on which the pirns rest. The lifter, E, is supported and guided by means of the rods, G, which slide up and down in the rails, B, the lifter being actuated by means of a rack and pinion movement at the back. The spindles, C, are driven in the usual way by means of endless bands, which pass round the wharves, C, fitted on the spindles below the upper collar rail, B. In fig. 2, the lifter, E, is shown in section, and broken, one portion being in the position it assumes when the pirn is wound about half. The pirns, H, are of the ordinary kind used in weaving flax, tow, jute, and other generally similar fibrous materials; they are formed with a turned wooden base fitted on to a tube which fits the spindle, C. The yarn, I, which is to be wound on the pirns, H, and to be used as weft, is carried from the rollers above down through an eye at the upper part of the flyer, D, round one of its legs, and through an eye at the lower part to the pirn. As the yarn is wound on to the pirns the lifter, E, is caused to descend slowly so as to form the cylindrical part of the pirn, and simultaneously with this movement, the lifter has imparted to it a short vertical reciprocating traverse which continually builds up the yarn in a conical form on the pirn. The combined motions resulting in the yarn being wound on the pirn in the desired form shown the full length of the pirn. To the inner faces of the end standards, A, are bolted the brackets, J, which form guides for the sliding brackets, K, which move up and down in the slots of the guides. To the lower part of one of the brackets, K, is bolted a vertical rack, L, which is actuated by a pinion, M, keyed on the horizontal shaft, N. This shaft is carried in bearings, fitted in the end standards, and it derives its motion from the top gearing of the machine. To the brackets, K, is bolted the longitudinal rail O, to which are centred two overhanging levers, P; the front extremities of these levers have attached to each a rod, Q. These pendent rods are passed through the eyes of the adjustable arms, R, which are secured by pinching screws to the rods, G, the rods, Q, being fastened in like manner to the arms, R. In this way as the shaft, N, rotates, the pinion, M, causes the rack, L, the rail, O, and the parts connected therewith to descend the downward motion, being so regulated as to build up the pirn to the required diameter. When the pirns are filled and removed from the spindles, the upward movement of the lifter is affected by means of the hand wheel, S, keyed on the extremity of the shaft, N; this is done whilst the spindles are being supplied with fresh pirns. The traversing rail, O, has bolted to its back part the overhanging brackets, T, in which are carried the bearings of the horizontal shaft, U, which is driven by the gearing of the machine. On the shaft, U, is keyed the heart wheel, V, which acts on a roller carried in the backward end of the lever, P, a corresponding arrangement being fitted at the other end of the machine. As the shaft, U, rotates the heart wheels cause the levers, P, to rise and fall, and impart a corresponding movement to the lifter, E. The extent of this reciprocatory traverse is equal to the depth of the cone of the pirn, so that the yarn is wound on in the conical form throughout, the cylindrical portion being due to the gradual descent of the lifter, E, to the full length of the pirn. In order to regulate the winding on of the weft, and secure a uniform tension on the yarn, a variable tensional drag movement is attached to the rail, O, which acts upon the pirns. A laterally projecting arm, W, is fixed to the rail, O; this arm is bent at right angles, as shown in fig. 1, and carries near its free extremity a boss, X, through which is passed the end of a bent lever, *v*. This lever is suspended from a loose stud, Z, which passes through a boss, *a*, fixed to the lifter, E. The other end of the stud, Y, is connected to the tumbler, *b*, which is secured to the eye plate, *c*; this plate is connected to the lifter, F, by screws passing through slots formed in the eye plate. The rising and falling motion of the lifter, imparts by means of the curved lever, *v*, and its connected parts, a slight lateral traverse to the eye plate. To the back of the lifter are attached a number of strings, *d*, corresponding to the number of spindles; these strings are passed through the eyes formed in the small upright pieces on the plate, *c*, and are passed round a portion of the flanges of the pirns, and connected to the small counterweights, *e*. These weights suspended from the strings, *d*, cause a certain amount of pressure or drag to be exerted on the pirns. The reciprocating movement of the eye plate causes the strings to press with a varying degree of force, so that the friction on the pirn is greater whilst forming one part of the cone than another, and this amount of tension is regulated so that the winding of the weft on to the pirn is uniform throughout. These improvements are specially adapted for the jute and linen manufacture, but they may also be readily applied to any other kind of spinning frame, used either with dry or wet yarn. This spinning frame is at the same time equally suitable for spinning warp yarn on to the ordinary bobbins, whenever it may be required for that purpose. With these improvements, the spinning and winding of yarn is greatly facilitated and economised.

PROTECTING METALLIC AND OTHER SUBSTANCES.

JOHN STENHOUSE, *Pentonville.—Patent dated Jan.* 21, 1862.

DR STENHOUSE has availed himself of the use of Paraffin, either in a solid state, or dissolved in any of the usual solvents—as, for exam-

ple, highly rectified coal tar, or petroleum naphtha, or bisulphuret of carbon, for the purpose of protecting of metallic surfaces, and rendering certain substances less pervious to air and moisture.

Gold and silver leaf, brass, tin, and tin foil, copper, bronze powder, Mosaic and Dutch gold, the various kinds of gilding and gilded articles, may be protected by this means.

The substances which may be rendered less pervious to air and moisture are—felt, flocks, woollen, silk, cotton, and flax yarn, manufactured skins and furs, artificial flowers and leaves; and this mode of applying the paraffin to the metallic surfaces consists in coating them therewith, and in applying it to the other substances, either by watering or impregnating them therewith. One mode of treating felted fabrics, yarns, manufactured skins and furs, is as follows:—A plate of iron or other metal is taken, the upper surface of which is quite clean, and is heated to a temperature of from 130° to 250° Fahrenheit, or even higher if desirable, either by placing it over a suitable furnace, or by means of high pressure steam, or a metallic or other bath. On this plate the skin, fur, or felted fabric is stretched, and on which it is held tight and flat by means of a frame or other suitable arrangement. When it has become sufficiently warm to soften or melt the paraffin easily, the felted fabric, skin, or fur, is rolled with a flat rectangular block of solid paraffin, with the hand or otherwise, so as to coat its surface as evenly as possible. The paraffin is usually applied to one surface only of the felted fabric, and to the flesh side of the skin or fur. The felted fabric is then strongly compressed, by means of a hot flat iron, or hot rollers, or other suitable arraugement, in order to distribute the paraffin more equally among the fibres. In the case of skins and furs, and occasionally also in that of felted fabrics, no compression is employed, but the paraffin is made to penetrate their substance simply by the application of heat. When the coating or impregnation of these substances is completed, they are taken off, and allowed to cool.

Sometimes, instead of a flat block of paraffin, a roller of that material is employed, made by pouring melted paraffin around a wooden core or axis placed in a suitable mould. The felted fabric, skin, or fur, is then drawn in a contrary direction to the roller, with which it is kept in very close contact by suitable pressure. The thorough incorporation of the paraffin with these substances is completed by calendering, either between hot metallic rollers, or by melting in the paraffin by means of heat, as in the previous case. Sometimes, also, the warmed felted fabric, skin, or fur, is drawn over a bar of any suitable form of paraffin, instead of over a cylinder of that substance, and the incorporation is completed by heating in any of the ways already described. Paraffin may likewise be applied to felted fabrics, skins, and furs, by rubbing it on strongly when cold, and then passing a hot iron over its surface, or by simply melting it in by the application of heat, in the way already described.

In other cases solid paraffin, heated in suitable vessels until it is not only melted, but its temperature is raised considerably above its melting point—a temperature of from 130° to 250° is found to answer very well. A plate of iron or other metal is heated to a temperature considerably above the melting point of paraffin, and on this plate a sheet of stout paper, or other absorbent material, such as linen, cotton, or woollen cloth, is placed, and evenly coated over with the melted paraffin, by means of a brush or other suitable instrument. The felted fabric, skin, or fur, which it is wished to impregnate, is then spread out on the paraffined surface above mentioned—in the case of skins and furs, with the flesh side downwards—and strongly compressed, by means of a hot flat iron, or by passing between hot metallic rollers. When the impregnation is completed, the material is taken out and allowed to cool.

When felted fabrics of considerable length have to be treated with paraffin, the process can be made continuous, by passing them over one or more hot wooden or metallic rollers coated with paraffin, by rotating in a bath of that substance. The excess of paraffin is removed by means of what is known as a "gauge-spreader," or "doctor," having a gauge or knife fixed above it, and furnished with screws, so as to regulate the amount of paraffin applied to the roller. The amount of paraffin can also be regulated by means of a brush or similar apparatus, also acting on a roller. The thorough incorporation of the paraffin and the substances above enumerated being subsequently completed, either by means of hot rollers or by the simple application of heat.

The quantities of paraffin which are applied to these substances, and the temperature to which they are exposed, vary exceedingly, according to their nature—that is to say, according to the thickness of the substance, and the amount of impregnation which it may be thought desirable to give them.

Any of the before-mentioned articles can likewise be treated with solutions of paraffin. The usual solvents of paraffin are employed for this purpose. Those which the patentee prefers are the most volatile portion of highly rectified coal tar, or petroleum naphtha, or bisulphuret of carbon, either singly or mixed. When these solutions have been made in the usual way by gently heating them, they are applied to the articles which it is wished to coat or impregnate, by means of a brush or any other suitable instrument. It is advisable to dry the substance thoroughly before applying the solution, and in cold weather to warm it, so that it may not chill the paraffin solutions. In the case of felted fabrics, skins, and furs, after the greater portion of the solvent has been removed by exposure to heat, it is generally advisable to subject the articles to the action of hot flat irons or rollers, or other suitable instruments.

When felted fabrics, skins, and furs, have been coated, or more or less impregnated with paraffin, in any of the modes described, they are not only rendered less pervious to air and liquids, but become both stiffer and stronger. Paraffin is therefore an excellent finish for certain kinds of felted fabrics. Flock, woollen, cotton, silk, and flax yarn, or artificial flowers and leaves, may be coated or impregnated with paraffin, by passing them through a paraffin bath or a solution of paraffin, or in any of the modes described most suitable to their nature;—such, for instance, as laying on the paraffin by means of a brush, or other suitable implement. Gold and silver leaf, brass, tin and tin foil, copper, bronze powder, Mosaic and Dutch gold, and the various kinds of gilding and gilded articles, can likewise be coated with paraffin in a similar way. Mixtures of paraffin with wax stearine, stearine acid, or any of the other solid fat acids, can also be employed in the same manner and for the same purposes as that already mentioned; but the patentee prefers employing paraffin alone.

MANUFACTURE OF TUBES, AND PLATING METALS.

JOHN WEEMS, *Johnstone.—Patent dated Nov.* 23, 1861.

THE patentee's improvements relate to the manufacture of metal tubing, which may be used as a substitute for more expensive metals, and so as to admit of being largely employed for various purposes of utility and decorative art. The patentee prefers to use zinc as a cheap and strong material, suitable for forming the tube, or this metal may be alloyed with one or more metals with a view of obtaining increased strength, or of reducing the prime cost of the article. The metal to be used for the purpose is, under one modification, made into sheets by the ordinary means, and afterwards cut into slips suitable for producing the tubing required. The strips of metal are then passed through dies or rollers to impart to each strip a cylindrical figure, the slips of metal, as well as the dies or rollers, being used either in the ordinary state, or heated with a view of imparting greater pliability to the metal. It is preferred to form these tubes with the aid of dies or rollers in such manner that the longitudinal edges of the metal are brought closely together, so that the two edges may be brazed or soldered with the aid of a gas-blowpipe or other equivalent contrivance. Or the edges may be bevelled off, so as to slightly overlap, and then be brazed or soldered—the object in either case is to produce a smooth and perfectly uniform tube. Or these tubes may be drawn or rolled solid, by first annealing the metal blocks or cylinders to make them pliable, and subsequently passing them through suitable dies or rollers to form the tubes. In either mode of forming the tubes, the dies, rollers, or mandrels, as well as the metal itself, are, by preference, kept in a heated state during the manufacturing process, either by means of steam, heated air, or gas, applied in any convenient manner to the several parts of the apparatus. The tubes thus formed are subsequently coated or plated with metal, which is done by immersing them in suitable chemical solutions, and precipitating the metal or metals with the aid of a galvanic battery. Zinc tubes formed in this manner perfectly smooth and cylindrical, and subsequently plated with copper, tin, brass, or other metal, are applicable to numerous purposes in the arts, for which copper and brass have heretofore alone been used, and to which zinc has not hitherto been applied. These tubes may also be plated with silver or gold, or be otherwise decorated with transparent colours, either by the stencilling or printing processes, so as to be available for various decorative purposes, as, for example, balustrades, parts of metal bedsteads, picture rods, and many other purposes where metal tubing forms the principal or secondary portion of the constructive details. The second part of this invention has reference to the coating or plating of zinc mouldings, beadings, astragals, brackets, and other struck work, so as to render such details far more largely available than at present, as well as being impervious to atmospheric influence, and admitting of greater scope in artistic decoration. In the manufacture of these constructive details, it is preferred to have the zinc annealed, or to work it in a heated state, so as to render it as pliable as practicable. In the subsequent treatment of these details, the surfaces may be plated with different metals, and these, with the combination of colour, afford a wide scope to the decorative artist. These plated or coloured details are also applicable to the decoration of furniture,

picture frames, gasaliers, and other generally similar purposes, in lieu of lacquered or ormolu work. These improvements are also applicable to the production of highly ornamental window blinds, and other generally similar purposes, in place of the wire gauze now ordinarily employed. Instead of gauze, the patentee uses finely perforated sheet zinc, but wire gauze may be used for the purpose if preferred. This perforated zinc or gauze is immersed in a suitable solution of silver or gold, and plated with the aid of a galvanic battery, and a diversified or damaskeen character may be given to the surface, by gilding one portion of the surface and silvering the other, and also by combining colour with the metallized surfaces. In this way a vast variety of beautiful designs of an economical and durable character may be produced in a manner and style altogether different from what is at present in use. For ordinary purposes, where durability is the principal point, the perforated zinc or gauze may be simply coated with copper, brass, or tin, and subsequently bronzed or otherwise ornamented. Large sheets of zinc may also be coated with any desired metal, and be applied in the construction of cisterns, and a variety of other useful purposes, so as to resist both chemical and atmospheric influences. The third part of the present invention consists in the manufacture of chemical and other vessels of zinc, or of a zinc alloy, which are subsequently rendered acid-proof by coating them with any of the metals or metallic alloys which are capable of being precipitated by galvanic agency or other equivalent means. In this way many of the articles which are now manufactured of expensive metals, may be replaced by vessels comparatively inexpensive, and at the same time as efficient in practical use. In all cases, where desirable, the article is coated with a transparent varnish, with a view of protecting the plated surfaces, so as to prevent the tarnishing of the metallized surface; this protective coating is of course more generally applicable to articles of a decorative character, and is not intended to apply to those, the surfaces of which are subject to severe abrasion. The patentee also prefers to coat articles formed of zinc, and which are not intended to be plated, with this protective varnish, which effectually prevents it from being influenced by air or moisture.

DRESSING YARN.

John M'Kean *and* James Gabbott, *Preston.—Patent dated January* 29, 1862.

The improvements introduced by the patentees have reference to the application and use of a new composition, to be used for sizing or dressing and preparing warp yarns for the looms, so as to enable such warp yarns to undergo the process of weaving. According to the ordinary and usual procedure in preparing warps for being woven, wheaten flour, sago flour, and other farinaceous or amylaceous matters and materials, are employed for dressing the threads of the warp, and laying, strengthening, and rendering elastic, the constituent fibres thereof. Flour and amylaceous elements from such sources are costly, and somewhat difficult of application; and they do not entirely fulfil the conditions practically required for duly fitting warps for the operation of weaving.

According to the present invention, the basis of the new composition consists of aluminous and silicious earths and compounds, such, for example, as that known as kaolin or china clay, or any suitable silicious or aluminous matter, mixed with certain mucilaginous and glutinous extracts, obtained from materials such as linseed and the refuse clippings of hides. The mode of preparing the mucilaginous and glutinous extracts is as follows. First, as to the glutinous extract:—20 gallons of water are put into a suitably arranged vessel, so that steam can be admitted externally or internally, and 10 lbs. of buffalo hide, or the waste of hides, or any animal size, and 5 lbs. of glue of fair quality are added thereto; then steam or heat the ingredients slowly for 24 hours, and add about 1 lb. of alum, or such quantity as may be found in practice sufficient to preserve the animal substances operated upon.

In order to prepare an extract of the mucilaginous matters contained in linseed, take 7 quarts of linseed (by preference Bombay linseed) and 20 gallons of water. Place these in a suitably arranged vessel, and subject them to the action of heat (by preference to the action of steam) for the space of about 10 hours. Each of the foregoing preparations, should they have been heated by the admission of steam, will consist of about 30 gallons in bulk when the several operations are completed. The solution of the animal size must be drawn off free from any undissolved matters, and the extract of linseed must be strained through a wire gauze or any other suitable filter.

To the above may sometimes be added about 70 lbs. of flour (by preference sago flour), previously mixed with an equal bulk of water, and incorporate by agitation. The whole is then ready for use, and may either be heated previously to being used in the sizing machine, or at a later period; it being only necessary to remark, that a temperature of from 148° to 150° Fahrenheit, will be the most suitable for the employment of the ingredients constituting the new compound.

Before, or during the heating of the compound, some tallow, or linseed, or other oil, may be added, at the option of the user, as is now the case when flour size is employed. I may mention that in practice it will be found convenient to prepare this new compound in larger quantities than herein mentioned. I have found quantities three or four times greater than those herein stated to be practically convenient.

A third composition is made by using the same ingredients and proportions as those which have just been described, except that 120 lbs. weight of common flour, or 100 lbs. weight of sago flour, are used instead of the quantities of these ingredients previously mentioned. This last mixture is preferred for "common sizing" and "dressing," as known in the trade in contradistinction to "tape" sizing.

Soft soap, or linseed oil, or tallow, may be added to the compositions, at the discretion of the manufacturer; but the patentees recommend that not more than one-half the proportions of such ingredients usually employed be used with the improved compositions.

By the adoption of any of these compositions great economy is secured, not only in the first cost of the material employed, but also in all the after processes of manufacture of the warp yarns into cloth; whilst the cloth, when finished, is of a class much superior to that produced from yarns sized or dressed in the ordinary way.

The patentees do not confine themselves exactly to any of the before-mentioned quantities—they are approximate only, and may vary with the option of every user; neither do they confine themselves to the above-mentioned sources of mucilaginous and glutinous extracts, it being evident that other sources exist which may possibly be found to be as economical and advantageous.

The patentees prefer to prepare the improved sizing or dressing material in three several ways, to suit the special requirements of the work. According to one process, take 30 gallons of each of the before-mentioned solutions, and add thereto 56 lbs. weight of china clay, or other suitable earth. These ingredients are thoroughly commingled in an agitating vessel, and the resultant composition is applied to the yarn in the usual manner. This composition is preferred when weight is not an especial requirement in the yarn.

The composition for general use is thus made: Take as before 30 gallons of each of the mucilaginous and glutinous solutions, and add thereto 224 lbs. weight of china clay, or other suitable earth; the whole being well agitated, and then passed into a boiling vessel, where there is added 100 lbs. weight of common flour, or 75 lbs. weight of sago, the flour being previously mixed in about its own bulk of water. The mixture is then heated by steam to a temperature of 150° Fahrenheit, when it thickens to a consistency which is best adapted for ordinary purposes. In the absence of any special boiling or steaming vessel, the steaming process may be carried on in the steam chest of the sizing machine. This composition is used when weight is an especial consideration.

LAW REPORTS.

Artificial Teeth: Harrington *v.* Ash and Another. Before Lord Chief Justice Cockburn, and a Special Jury, at Guildhall, London. 7th July, 1862.

This was an action for the infringement of a patent. In 1849, the plaintiff, a dentist at Ryde, obtained a patent for improvements in the manufacture of artificial teeth, and the beds and palates for teeth, which patent it was alleged the defendants, who are manufacturers of artificial teeth in London, had infringed, although they had formerly obtained a license from the plaintiff to manufacture under the patent. The defence was, that the alleged invention was destitute of novelty at the date of the patent, inasmuch as many persons had been found who would say that they had made use of the system claimed by Mr Harrington previous to the patent.

The patent right claimed by the plaintiff, is the manufacture of artificial teeth, where mineral teeth are used, in the mode described in the specification, whereby the making of the teeth to the particular case, or leaving a sufficient substance at the base of the tooth or teeth to allow of being ground or cut way to fit a particular ease, and the subsequent cutting of the surfaces of the mineral teeth which come next the mouth in order to fit the beds and palates, are rendered unnecessary. According to the plaintiff's system, artificial mineral teeth are moulded in set sizes to suit the requirements of general practice, and made of such a form as to be entirely clear of the gum, the space or recess left between the teeth and the gum being filled in by a moulded bed or palate made on the underside or surface to fit the gum in the ordinary manner, and on the top or front surface to fit the base of the tooth, whereby the bed is fitted to the tooth in contradistinction to the ordinary methods in use prior to the date of the plaintiff's patent, wherein the tooth was fitted

by careful grinding to the surface of the bed or palate. In other words, it was formerly necessary after the teeth, which were fitted to the palate or bed, had been subjected to the process of vitrification, to grind them very carefully for the purpose of making them fit the palate or bed—a difficult and delicate operation. Now the plaintiff's alleged invention consisted in this, that instead of fitting the teeth into the palate or bed which they were to occupy, he adapted the palate or bed to them.

At the trial, Mr Bovill, Q.C., and Mr Webster, Q.C., instructed by Mr J. Henry Johnson, 47 Lincoln's Inn Fields, appeared for the plaintiff, and Mr Grove, Q.C., Mr Hindmarch, Q.C., and Mr Theodore Aston for the defendants. After the plaintiff and another witness had been examined in support of the plaintiff's case, and several witnesses had been called for the defendant to show want of novelty, the learned judge addressed the jury, and left it to them to say whether what had been done according to the testimony of the latter witnesses, previous to the date of the patent, was substantially that which the plaintiff claimed as his invention.

After a short consideration, the jury returned a verdict for the defendant on the plea of want of novelty, and for the plaintiff on the issue as to the infringement.

Sewing Machines: The Grover and Baker Sewing Machine Company *v.* Millard. Rights of patentee against licensee. Before Vice-Chancellor Sir W. P. Wood. July 11.

In the year 1852 letters patent, dated August 10, 1852, were granted to Edward Joseph Hughes for an invention of "improvements in machinery or apparatus for spinning and weaving cotton, wool, and other fibrous substances; and also in machinery or apparatus for stitching, either plain or ornamentally." These letters patent, the specification to which was subsequently amended by disclaimer, ultimately became vested in a trustee for the plaintiffs, who agreed to grant to the defendant a license to use the same. Accordingly, by an indenture, dated 23d November, 1860, the plaintiffs granted to the defendant a license to use the invention, so far as regarded the feed mentioned in the first claim of the specification, for the remainder of the term of the patent, at a royalty of £1 for every machine made under the license; and it was thereby agreed that the said royalty should be paid by the purchase of license plates, as thereinafter mentioned; and the defendant covenanted that he would, from time to time, during the continuance of the license, purchase from the plaintiffs at least ten license plates bearing the words "The Grover & Baker Sewing Machine Company's Patent Feed, 1852," and at the time of each such purchase, pay the sum of £1 sterling for each of such plates; and also, that he would not use, sell, or otherwise dispose of, or expose to public view, any machine made by virtue of the said license, without such machine having first affixed thereto, on some conspicuous part thereof, one of such license plates. The plaintiffs having ascertained that the defendant was selling machines made under the license without license plates being first attached thereto, gave him notice of their intention to insist upon the observance of the above covenant, and required him to desist from such sales. The defendant, however, continued to sell machines to which license plates ought to have been attached, without the same being affixed thereto, and the plaintiffs accordingly, on the 14th July, 1861, filed their bill, praying for an injunction and for an account and damages, and that the defendant might pay the costs of the suit. The defendant did not appear to the bill; and on the 29th July, 1861, the plaintiffs moved for and obtained, on affidavit of service, an injunction until the hearing of the cause. The order for the injunction was served on the defendant personally.

The defendant, shortly after the bill was filed, withdrew himself beyond the jurisdiction of the court, and never put in an answer to the bill. The plaintiffs, therefore, obtained an order to take the bill, *pro confesso*, against the defendant, and the cause now came on for hearing.

It appeared that since the filing of the bill, the plaintiffs had brought an action upon their patent against an infringer, which had resulted in a verdict against the plaintiffs on the ground of the insufficiency of the specification (see Price *v.* Carver, ante., p. 125). Mr W. N. Lawson (instructed by Mr J. Henry Johnson) appeared for the plaintiffs, and having stated the facts, submitted that the above-mentioned adverse verdict afforded no reason why the court shou'd refuse the prayer of the bill. He cited authorities to show that it had been held, that in an action for royalties under a license to work a patent, the defendant is not at liberty to plead that the patent is invalid. The plaintiffs were willing to waive the relief asked as to account and damages.

Vice-Chancellor Sir W. P. Wood, upon the authorities cited, made an order for a perpetual injunction in the terms of the prayer of the bill, and that the defendant should pay the costs of the suit.

REVIEWS OF NEW BOOKS.

Hand-Book of Economic Literature; being a Descriptive Catalogue of the Library of the Twickenham Economic Museum. Part I. Domestic and Sanitary Economy. 1862.

This pamphlet has been printed for Mr T. Twining, the philanthropic owner of the Economic Museum, located at Perryn House, Twickenham, near London. Mr Twining issues tickets for admission to the museum on Wednesdays and Saturdays, from 2 to 5 o'clock. The object and contents of this museum are described in the introduction to the present catalogue, from which we make the following long extract:—

The terms Economic Exhibition and Economic Museum, have been adopted to designate collections, temporary or permanent, illustrating the various branches of domestic and sanitary economy, and intended to impart to all classes of the community—more particularly to those whose income is small—the *knowledge of common things*, or *science of every day life*; showing what sort of dwellings they should live in to secure health and comfort, what improvements in household management they may derive from the discoveries of science, or from the customs and appliances of other nations, what fabrics they should wear, what food they should eat and how it ought to be cooked, how they may distinguish things which are genuine, wholesome, substantial, durable, and really cheap, from those which are good and cheap only in appearance—in short, how they may live with judgment, and get the best money's worth for their money. The practicability of the scheme as regards *temporary* exhibitions has been abundantly testified by the success of the Economic Exhibitions, at Paris in 1855, Brussels in 1856, and Vienna in 1857. *Permanent* Economic Museums, though more troublesome in their formation and less exciting, will, however, have a more important influence: Firstly, by offering to benevolent persons that guidance in their endeavours to benefit the poor, of which the want has so often been felt. Secondly, by keeping before the working classes an attractive means of self-instruction. Thirdly, by gradually becoming a standard appliance in juvenile education.

For these purposes, economic collections, varied in form and dimensions according to local requirements and resources, should be established throughout the length and breadth of the land. London should have its economic museum on the fullest scale; provincial towns should have affiliated collections; mechanics' institutes should have a room allotted to illustrations of the science of common life; lecturers should be supplied with portable economic collections; and educational establishments, even down to the village school, should have their economiums, or cabinets of useful objects.

The present collection, after having been exhibited in embryo at the South Kensington Museum and at the Polytechnic Institution, has been removed to Twickenham for more convenient development. For the present, it is not intended to be a means of *direct* instruction to the working classes, but it may prove useful to their benefactors as a place of reference, and much facilitate the formation of economic museums, on any scale, by illustrating principles of classification which have been tested by experience, by showing the articles, diagrams, &c., which may be selected and where they may be procured, by exemplifying the system of instructional labelling which forms so essential a feature in the economic scheme, and by displaying a variety of arrangement, fittings, and appliances, with estimates of cost showing how much may be done with limited means, provided educational value be considered rather than appearance.

The museum is divided into nine classes, as follows:—Class I.—Building designs. Class II.—Building materials. Class III.—Furniture. Class IV.—Clothing. Class V.—Food, fuel, and other Household stores. Class VI.—Health. Class VII.—Home education. Self-instruction. Recreation. Class VIII.—Miscellaneous. Class IX.—The Library.

The economic library consists of British and foreign publications and documents on domestic, sanitary, educational, social, and charitable economy, selected and arranged for the following purposes:—

To afford a suggestive example of a library of economic and benevolent knowledge, of which the selection, classification, and other peculiarities, may be imitated in the formation of popular reading-rooms attached to economic museums or otherwise, and varying in range of subjects, completeness, and style, according to special requirements and resources. They may be adapted either for the direct use of the working classes, or for the instruction and guidance of those who would promote their welfare.

To present to persons desirous of forming economic and educational museums the following facilities: (*a*) A series of printed and manuscript documents, explaining the principles which should form the ground-work of such undertakings. (*b*) Catalogues of useful inventions, and other lists, showing the articles which may be selected and where they may be obtained. (*c*) Books of general or special reference, giving technological and other information for the compiling of instructional labels.

To indicate the best sources for compiling popular lectures on household and health economy.

To complete the information afforded by the instructional labels in the other classes of the museum, where lists will be posted referring to the library for the most appropriate books.

To make better known a class of publications which has sprung up, of late years, to supply that scientific knowledge of common things still so deficient in the education of all grades of society in England, and yet so necessary for the health and comfort of all.—Some of these books are such as should find a place in every working man's home, and many are well suited for presents to the young.

To afford to benevolent persons any information they may require in giving

advice on sanitary matters, and guidance as to the publications which may he beneficially distributed, in order to raise the physical, as well as the moral and intellectual, condition of the poor.

To show the present state of sanitary science and legislation, as regards public health, and to draw attention to means for improving the dwellings of the working classes.

To make known the books and tracts best suited for diffusing, as a part of juvenile and adult education, sound principles of physiology and hygiene.

To bring together British and foreign documents relating to the accidents, injuries, and diseases, which attach to various industrial occupations, and the means of prevention or relief.

The foregoing purposes are chiefly subserved hy the first section of the library. Section 2 will give to persons interested in the education of the working classes an opportunity of becoming acquainted with some of the means best adapted for that purpose, including, (*a*) Lists of publications adopted in reliable schools, or recommended by competent authorities. (*b*) Specimens of cheap elementary series. (*c*) Sets of pictorial illustrations, with explanatory text. (*d*) Lesson-hooks on common objects, especially those intended to serve as text-books to the valuable economic and technological cabinets lately introduced as educational appliances. (*e*) Popular introductions to science, suited for the self-instruction of adults.

This section is in connection with Class VII. of the museum, where provision is made for educational illustrations requiring space for their display. It is hoped thus to give a tolerably clear notion of the means for rendering recreation instructive and study practical, appertaining to the educational system promoted by the leading educational societies, and of which the principles may perhaps be summed up as follows: To instil instruction in such a manner as to pervade all the actions, sentiments, and circumstances of life; to supersede as much as possible the mere drilling of the mind by labour without intrinsic purpose; to train the intellect in natural and healthy development, hy an easy concatenation of ideas, husbanding the powers of the youthful brain, carefully directing them according to capabilities and prospective requirements, and teaching to make an intelligent use of the knowledge acquired. Finally, to comple physical with mental hygiene, and to realise the motto, "Mens sana in corpore sano."

Section 3 represents *in parvo* those branches of social science which deal especially with the condition of the working classes, the relations of employed and employers, the organization of industry and trade; the formation, management, and statistics of provident and benevolent institutions; schemes for benefiting the poor, laws affecting their welfare, penal and penitentiary subjects considered from a philanthropic point of view, &c., &c. It includes also compendiums of law for common use, and a few standard books required by magistrates and parochial authorities.

The next two sections of the library are devoted to prospectuses, reports, and other documents relating to the practical working of institutions of every description for provident or benevolent purposes in England and abroad. The foreign section numbers many interesting papers concerning foreign institutions, contributed by Continental friends, with whose assistance it is hoped that this department may acquire an important development.

Elliott's Stereoscopic Views of London and its Neighbourhood.

We have been much pleased with a series of stereoscopic views of London and its immediate neighbourhood, submitted to us by Mr G. E. Elliott, of 5 Aldermanhury Postern, City, and can recommend them to the notice of collectors for their beauty and fidelity. Of course, persons will select according to their individual tastes; but those which have most pleased ourselves are views of St Paul's, the Royal Exchange, the General Post Office, the Houses of Parliament, and some of the streets crowded with carriages and foot passengers. There are views on the river, too, very effective for the play of light on the water, and for their depicture of clouds. Country cousins will do well to look at these views when choosing articles for the amusement of their friends at home.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

A NEW METHOD OF PRODUCING MOTION BY HEAT.

Sir,—I now communicate to your readers a new mode of producing motion by heat, which, I am ready to confess, was suggested to me by the experiments of Mr Gore.

A cylinder of brass, or any other metal, must be provided, the length, diameter, and thickness of which is not of any consequence, it only being necessary that the thickness be uniform, and the metal as homogeneous as possible. The internal edges of the cylinder must be raised by means of rims, the use of which is to keep in one or more balls, for which purpose they must, of course, be sufficiently broad. A ball or balls, either of stone or metal, may be made use of. The cylinder must be placed upon a level surface, and a ball must be heated, and then placed inside it, when, under certain conditions, it will almost immediately revolve, which revolution will continue until the whole of the cylinder is equally heated, or has attained the same temperature. The motion will occur only if the vibration consequent upon the elevation of the centre of gravity of the cylinder, which is caused by the expansion of its lower parts, is not prevented from producing palpable motion by the weight of the ball or balls; or if the expansion on both sides of the line of contact is not the same, the consequence of which would be that the centre of gravity of the cylinder would be thrown somewhat towards the side which had the most been expanded. The experiments of Mr Gore can be explained—the heat of the rails being communicated to the ball.

While writing upon the subject, I should observe, that it would be of philosophical, and, perhaps, practical utility, to measure the vibrations accruing from placing heated pieces of metal upon cold pieces, which measurements could, of course, accurately be made by means of the enlargement consequent upon the use of mechanical leverage. The cold pieces should be placed upon stands, and these should be connected with levers, and an index moving over a very accurately graduated dial.

July, 1862. J. Alex. Davies.

THE IMPERFECTIONS IN THE PERSPECTIVE DELINEATIONS OF MECHANICAL, ARCHITECTURAL, AND OTHER OBJECTS.

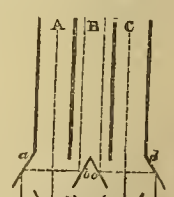
Sir,—Those who will carefully inspect the generality of perspective drawings of every kind, must allow the majority of these representations, as regards their perspective character, are to no small extent imperfect or unnatural; and, seeing that this is the case, I would direct the attention of draughtsmen, and painters generally, to two of my inventions, which I have already described, (*Mechanics' Journal*, Nos. 86, 102, new series,) and which, if attended to, would prevent the various abortions which are to be found in the majority of perspective delineations.

The fact that, as regards the most of them, no point can be supposed as the position of the eye, without it being apparent that some of the parts and shades represented, are *not* representations of the real objects from the given position, shows, of course, that, in the absence of a very accurate eye, perspective delineation should of necessity be made a scientific procedure. The rules which I have given, would, if practised, elevate merely an art into a science; and the bungling which has been referred to would consequently be prevented. The drawing of the Montreal Tubular Bridge, (*London Journal*, February 11, 1860,) is the most extraordinary piece of pseudo-perspective delineation with which I ever met, in which its width is represented as actually more than twice its length, the want of proportion of which will be seen when it is known that, while the width throughout of the tubes is only sixteen, their length *alone* is 6138 feet! The rule which has been described in No. 86 of the before-mentioned magazine, relates to the proper positions of lines and angles, and that to be found in No. 102 to curved parts, as cogged wheels, architectural ornament, &c., which together, of course, include every possible variety of delineation.

July, 1862. J. Alex. Davies.

A LANDSCAPE DIVERSIFIER.

A curious optical instrument, capable of producing the effect signified by the above name, could be constructed by virtue of the principle of reflection. A short tube, or rectangular case, should be divided into three equal parts, which are represented hy A, B, and C; and the reflectors, *a*, *b*, *c*, *d*, should be arranged as shown, which would cause the various luminous rays parallel to those represented by the dotted lines in the tubes, in every case to be reflected either parallel with, or at a right angle to them, and other angular rays, according to their angularism, to be reflected to the eye, which could be placed at any distance from the mirrors. The tube or case should be about six inches long, in order that the field of view formed by objects at great distances should not be very large, which condition, I think, would render the transpositions unnatural. It will he seen, upon an inspection of the diagram, that the rays passing through the central division would be reflected outwards, and that those traversing the outer divisions would fall inside; and also that the tube could be divided into more or fewer parts, and the mirrors otherwise be arranged. I may here say, that some eighteen months ago I sent a description of this invention to a scientific journal, and that it was not then published; and also that, as far as I am aware, it has not as yet been described.



J. Alexander Davies.

August, 1862.

MECHANIC'S LIBRARY.

Analysis, Volumetrical Handbook of. Scott. Crown 8vo, 4s 6d, cloth.
Algebra, for Colleges and Schools. Todhunter. 3d edition. Crown 8vo, 7s 6d, cloth.
Arithmetical Examples, Key to. Davies. 18mo, 1s, cloth.
Agriculture, Hints on, for Landlords and Tenants. Finney. 1s, sewed.
Book-Keeping, System of Practical Morrison. 8vo, 8s.
Botanists' Field Companion. Moore. 21s. cloth.
Essays on Scientific Subjects. Holland. 8vo, 14s. cloth.
Exhibition, Handbook to the Industrial Departments of. Hunt. Vol 1. 3s 6d.
Farm, Our, of Four Acres. New edition. 12mo, 1s, boards.
Fruit Trees, Science of Grafting. De Breuil. Translated by Wardle. 6s, cloth.
Ferns, British. Drawings by Fitch. Hooker. Royal 8vo, 42s, cloth.
Fungi, Plain and Easy Account of British. Cooke Fcap 8vo, 6s, cloth.
Homesteads, Prize Designs for Covered. Tuckett. 8vo, 5s, cloth.
Hydrology. Manual of. Beardmore. 8vo, 42s, cloth.
Observer, Intellectual. Vol. 1. Crown 8vo, 7s 6d, cloth.
Projection, Treatise on Orthographic Binns. 9s, cloth.
Punctuation Reduced to a System. Day. 7th edition. 18mo, 1s, cloth.
Stereoscopic Magazine. Vol. 3. 8vo, 42s, cloth.
Turning, Handbook of. New edition. 12mo, 7s 6d. cloth.
Ventilation, Natural and Artificial. Ritchie. 8vo, 8s 6d, cloth.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

MANCHESTER—THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the last Ordinary Monthly Meeting of the Committee of this Association, the chief engineer presented his Monthly Report, of which the following is an abstract:—"During the last month there have been examined 323 engines and 563 boilers. Of the latter two have been examined specially, 1 internally, 95 thoroughly, and 465 externally, in which the following defects have been found:—Fracture, 16 (2 dangerous); corrosion, 46 (8 dangerous); safety-valves out of order, 11 (1 dangerous); water gauges ditto, 19 (4 dangerous); pressure gauges ditto, 14; feed apparatus ditto, 11; blow-off cocks ditto, 28 (1 dangerous); fusible plugs ditto, 6; furnaces out of shape, 10 (3 daugerous); blistered plates, 7; Total, 168 (19 dangerous). Boilers without glass water gauges, 12; without pressure gauges, 2; without blow-off cocks, 50; without back pressure valves, 98.

"Three explosions occurring during the past month, to boilers not under the inspection of this Association, have come to my knowledge. One of these took place in Manchester, the other in the neighbourhood of Newcastle, and the third in London, while all three were attended with fatal consequences. The plates of the first are reported as having been found, on subsequent investigation, so reduced by corrosion, as not to have exceeded the thickness of a sheet of paper; while it is worthy of remark, with regard to the second, that its explosion had seriously damaged another boiler alongside of it, which, however, fortunately happened at the time to be out of work, or, from the injuries it received, it must have exploded in turn. This is frequently found to be the case, and the fact is of interest, as affording an indication of the variety of forces developed hy explosion, which, as has been previously pointed out, evidently cannot be summed up merely in that of disruption and the reaction consequent on unbalanced pressure.

"In addition to the above, however, it becomes my duty to report the occurrence of an explosion to one of the boilers belonging to a member of this Association, and which, it is to be regretted, was attended with loss of life to the fireman.

"This is the third fatal explosion which has happened to any of the boilers under the inspection of this Association since its establishment, nearly eight years ago, to which should be added three cases of collapse of furnace flues, not attended with any serious consequences, and which arose in two instances, if not in all three, from shortness of water. During this period, 656 dangerous defects have been pointed out in the boilers under inspection, from which serious injury might have arisen in each case; while, upon limited inquiry only, it has been found that no less than 202 fatal explosions have occurred in that time to boilers not under the inspection of this Association, which have been attended with the loss of 438 lives, in addition to serious injury to 476 persons, and considerable damage to property.

"The explosion last referred to occurred to one of a pair of ordinary cylindrical double-flued boilers, working side by side, and connected together. Both boilers were set upon mid-feathers, and were of precisely similar construction and dimensions, the length of each being 34 feet, the diameter of the shells 7 feet, of the flues 2 feet 7½ inches, and the thickness of plates $\frac{3}{8}$ths of an inch throughout, with the exception of the flat ends, which were $\frac{9}{16}$ths of an inch. The fittings consisted in each case of a glass water-gauge; a back pressure and feed stop-valve combined; a blow-out valve, of mushroom construction, opening against the pressure in the boiler; and a lever safety-valve, loaded with a single weight to a pressure of 35lb. per square inch; in addition to a steam pressure gauge common to both boilers as long as both junction valves were open, but not otherwise.

"The explosion was occasioned by a rent in the shell, which took place directly through the line of rivets, at one of the longitudinal seams in the second ring of plates from the front of the boiler, the seam being on the right hand side, three feet from the centre or "keel," line at the bottom. The construction of this seam was such that the edge of the outer plate was uppermost.

"The cause of the rent was thinning of the plates at this seam by external corrosion, through which it had become reduced to about $\frac{1}{16}$th of an inch in thickness. The corrosion extended throughout the length of the seam, which was about 2ft. 6in., and affected the plates on both sides of the lap to a width of from 4 to 6 inches. The rent did not extend longitudinally beyond the limit of this ring of plates, but ran along the transverse seams of rivets on each side of it, almost severing a complete belt from the boiler. The reaction from this opening raised the boiler momentarily almost on end, as was attested by the character of the fracture of the connections, the indentations in the bottom plates, and the fact that a pipe, previously overhead, had become buried beneath it, while the twin boiler alongside was blown bodily in a lateral direction. Had the longitudinal seams of rivets, instead of breaking joint, been in line, which is too frequently the case, the rent would certainly have run from one end of the boiler to the other, and the destruction of property, and very probably that of life also, have been more serious.

"This defect was one that could scarcely have escaped detection on a careful examination of the condition of the plates in the external flues. Still, it should be borne in mind that the plates of boilers set on mid-feathers are neither as accessible or visible as they are in those set on two side walls with a split flue. The side flues in the latter case admit of coming face to face with the plates and seams in a manner which cannot be done in the former, in which many of them can only be seen obliquely at a very great disadvantage, while those at the upper part of the flue, in what may be termed the tip of the wing, are frequently out of reach altogether.

"All the members must be aware that, for the express purpose of detecting such defects as the above, the Association affords, in addition to the external inspections, the opportunity of having every boiler 'Internally and Thoroughly' examined at least once a year. The importance of these 'Thorough' examinations has been repeatedly called attention to, and every opportunity taken to promote their being made, and, in order to suit the convenience of members as to time, the ordinary routine of visits is entirely set aside at holiday times, such as Whit-week, Christmas, Easter, and race weeks, so that the Inspectors may exclusively devote themselves to this special service.

"It is much to be regretted that the Association was not afforded an opportunity of making a 'Thorough' examination of this boiler, either in the year 1860 or 1861, and, when in consequence of attention being specially called to this omission, our Inspector—at the request of the owners—visited the works last Easter, the boiler was found unprepared, the flues being imperfectly swept, and the plates coated with soot, although the visit had been expressly appointed, in order to effect a 'Thorough' examination. Under these circumstances, no satisfactory examination could be made, which was distinctly stated to the engineer at the time, and subsequently officially reported in writing to the owners. So clearly was this understood, that the next time the boiler was stopped, the manager of the works went up the flues himself in order to complete the examination, which the want of preparation had previously prevented our Inspector from doing."

MONTHLY NOTES.

Hull.—In 1861 the population was returned at 109,000; and this year it is estimated at 110,800; while in 1836 it was only 65,000. The property rateable last year was 238,504*l.*; and in 1836, 176,559*l.* In 1860 the tonnage of the shipping entering the port was 833,633 tons, as compared with 490,044 tons in 1836; and the clearances outwards were 798,217 tons in 1860, against 421,938 tons in 1836. In 1836 the area of the docks was 23a. 0r. 39p.; while now the area of the dock accommodation is 40a. 5r. 28p.; and the area of the proposed new West Dock is 17a., and the increase to the Victoria Dock is 6a.

Patent Law Commission.—Her Majesty has been pleased to appoint the Right Hon. Lord Stanley, Lord Overstone, Chief Justice Erle, Sir W. P. Wood, Sir W. Atherton, Sir H. M. C. Cairns, H. Waddington, Esq., W. R. Grove, Esq., Q.C., W. M. Hindmarch, Esq., Q.C., W. C. Forster, Esq., and W. Fairbairn, Esq., to be Her Majesty's Commissioners to inquire into the working of the law relating to Letters Patent for Inventions.

Ellis' Bridge Rail.—A new form of the Bridge Rail has been recently introduced by Mr Thomas Ellis, of New Swindon, Wilts. The accompanying illustration shows the rail in transverse vertical section. The advantages claimed for this rail are—its having a flat or solid surface, its whole breadth to bolt down to the timbers, as shown in the cut; the impossibility of its collapsing, as is alleged to be the ease with all other bridge rails; its being perfectly rigid; the bolts remain firm in the timber until the rail is quite worn out. It effects a saving in the timbers of from 50 to 100 per cent., as their is no liability of their being torn and splintered by shifting. The patent rail at 62 lbs. per yard is sufficiently strong to carry the heaviest engine on the Great Western Railway, its shape admitting of its being rolled at a less weight to the yard without diminishing its strength or durability. This rail has been submitted to several of the principal engineers and practical men of the day, who have pronounced it the best that has been produced. It carries off the palm for lightness, durability, and consequently cheapness.

National Education.—Since the formation of the committee of council on National Education up to the present time £6,000,000 have been expended in building and maintaining schools and training and paying teachers. The annual grant thirty years ago was £20,000; this year it is upwards of £800,000.

During last year 60 Inspectors were employed in visiting schools and in holding examinations. They visited 10,900 daily schools or departments of such schools under separate teachers. They found present in them 1,028,690 children, 8,069 certificated teachers, and 15,498 apprentices. They also visited 39 training colleges, occupied by 2,869 students. They likewise furnish reports on 442 schools for pauper children, containing 32,481 inmates, and 58 ragged or industrial schools, containing 4,411 inmates.

Petroleum Act.—This Act (25 & 26 Vict. c. 66) contains provisions for the safe keeping of petroleum, and any product thereof that gives off an inflammable vapour at a lower temperature than 100° Fahrenheit. Every vessel laden wholly or in part with petroleum must, on entering a harbour, conform to the regulations of the harbour authorities, under a penalty not exceeding £20 a-day After the 1st October next, not more than forty gallons of petroleum may be kept within fifty yards of a dwelling house, or of a building where goods are stored, except under a license to be granted by the local authority. Petroleum kept in contravention of this regulation sball be forfeited, and the occupier of the place where it is kept shall incur a penalty not exceeding £20 a-day. The Act explains who are meant by the expression of "the local authority," and directs that their licenses may be granted for a limited time, and that conditions as to renewal, or for the diminution of the risk of damage from explosion or fire, may be inserted therein at the discretion of the local authority. In case a license is refused by the local authority, the applicaut may memorialize the Secretary of State, as regards England and Scotland, or the Lord Lieutenant in Ireland. Petroleum may he searched for in the same manner, under the same warrants, and subject to the same conditions in, under, and subject to whieh gunpowder may be searehed for under the Act of 23 & 24 Vict. c. 139.

The National Income and Expenditure.—During the year ending the 30th of June, 1862, the total revenue amounted to £69,685,788, the items being as follows:—Customs, £23,644,000; Excise, £18,047,000; Stamps, £8,657,945; taxes (land and assessed), £3,154,000; property-tax, £10,549,000; Post-Office, £3,535,000; Crown lands (net), £296,000; miscellaneous, £1,802,843. The total expenditure, including £1,t20,000 for fortifications, was £71,527,867, made up as follows: – Interest on public debt and analogous sources of expenditure, £26,224,453; charges on the Consolidated Fund, £1,940,33t; supply services, £42,243,082. The details of the charges on the Consolidated Fund and of the supply serviee are as follows:—Civil list, £403,610 10s 10d; annuities and pensions, £303,617 10s 3d; salaries and allowances, £156,028 0s 1d; diplomatic salaries and pensions, £174,239 6s; courts of justice, £694,819 19s 10; drawback on wine (per Act 23d of Victoria, cap. 22), £386 0s 3d; other charges, £207,630 3s 11d; Army, £15,474,789 10s 9d; Navy (excluding packet service), £12,430,588; miscellaneous Civil services, £7,594,913 8s 5d; salaries, &c., of revenue departments, £4,617,440 6s 9d; packet servive, £841,920 11s 6d; China, naval and military operations, £1,230,000; extraordinary expeuses of the late Russian war, £53,430 15s 10d.

Enamelled Cloth.—The black enamelled cloth is the kind most largely in use; but the method of making the different colours is essentially the same, the black being the foundation, and the colours afterwards applied by hand. The basis of the black is cotton cloth of the best quality, made expressly for the purpose. It varies in texture and width, according to the kind of goods for which it is intended, the width being from thirty-four to fifty-four inches. The cloth is taken from the bale, and wound upon a large iron cylinder, in which position it is ready to receive its first coat, by being slowly passed through the machine across and between the huge iron cylinders, from the smaller of which, at the top, it receives its first coating of composition—a mixture of oil, lamp-black, rosin, and other ingredients, boiled together till about the consistency of melted tar. From between the cylinders, dressed in its black coat, the cloth is carried to the story above through an aperture in the floor, and wound upon a huge wooden frame, resembling in shape the old-fashioned reel. By an arrangement of spokes upon the arms of this huge wheel, each layer of cloth is kept separate, so that no two portions of the cloth will come in contact. The frame, with its contents, when filled, is passed into what is called the heater, an apartment kept at a high temperature, for the purpose of drying in the coating of composition. After remaining in the heater a sufficient time to complete the drying process, it is removed to the lower story, whence it originally started, to pass through the hands of workmen, who make all the rough places smooth. It is laid on long tables, and aternately sprinkled with water and rubbed with pumice-stone till the whole surface is made perfectly smooth. The cloth is then wound upon the cylinder again, as at first, and passed through the machine into the upper story, upon the huge reels, and into the heater, and again under the pumice-stone. The cloth is passed through the machine five times, or till the required thickness has been laid on. After the last scrubbing down, the fabric is taken to another department in the upper story, thoroughly varnished, and again passed through the heater. It is now a piece of cotton cloth, with a thick shining coat of black, very much resembling patent leather. But it has not yet received its leather finish; so, in another department, it is passed through the enamell machine, which consists of another set of buge rollers, one of which covers its surface with irregular indentations, resembling the grain of leather.—*Technologist.*

The Central Cottage Improvement Society.—This society has erected on the grounds attached to the South Kensington Museum, a pair of cottages under one roof, as a model of what such structures ought to be. They deserve the attention of those who contemplate the erection of cottages, whether for the labouring poor in their employ, or from motives of benevolence. Each cottage contains on the ground floor, a sitting, bed, or work room, 12 feet by 10, in which are a press-bed and two cupboards; a kitchen, 12 feet by 9, fitted with an oven and boiler range; a pantry and store-eloset and a wash-house, 8 feet 6 inches by 7 feet 9 inches, with a fire-place, fire-clay oven, copper, sink, and dresser; while on the upper floor there are two bed-rooms, 12 feet by 10 and 12 feet by 9, with fire-places, stoves and store-elosets. The cost of the pair was £215; at which rate a 5 per cent. return, with a surplus for repairs would be given, by a rent of £6 10s per year, or half-a-crown a week. The cottages are substantially finished and well ventilated. They possess every convenience that the family of a labourer can require, and they can be offered to the working classes at less than they pay for the filthy unhealthy abodes too many of them at present occupy. Landlords can obtain specifications and working plans on payment of 5s to the secretary, from whom orders to view the cottages may be obtained. The office of this excellent society is at 37 Arundel-street, Strand, where there is a collection of plans and models to be seen

Natal in the Exhibition.—The collection of articles from our colonies is allowed by all to be one of the most striking features of the present Exhibition, compared with that of 1851; and amongst these collections that from Natal is, considering the extent of the colony, perhaps the most remarkable. A small court has been allotted to them, and here the intending emigrant, or those who have friends in that distant corner of Africa, may in half-an-hour glance over the natural productions of the place, and see to what objects our relatives are there devoting themselves. The Commissioners from the colony have wisely issued a descriptive catalogue of their contributions, written by Dr Mann, who is known as the author of a work on the colony. First we may refer to a large map of the colony, which hangs in a conspicuous position, accompanied by a section of the country, from the coast across the mountain ranges of the interior. The surface line is extremely irregular with many ups and downs, affording a great range of climate from that of the hot coast to that of the cool mountains. The productions are consequently those both of semitropical and temperate regions. The former are represented by sugar, tobacco, cotton, coffee, arrowroot, ginger, capsicum, and fruits such at those from the Doom palm and the Mango tree; the latter by sheep's wool, pulse, wheat, barley and oats. The warmth of the climate on the lowlands is also demonstrated by the skins of savage animals, and the stuffed birds of beautiful plumage. The natural history is further illustrated by collections of fishes, reptiles and insects preserved in spirits, or shown in cases. Here, too, may be seen elephants' tusks, and many borns, both long and short, with the skulls attached;—leathers prepared and in the rough; feathers made up ornamentally; and woods suitable for furniture or construction. Amongst the latter will be noticed a few that are pretty when polished. Of these, perhaps, the prettiest is an *Oresdaphne*, a genius that keeps up its reputation both there and at Madeira, for its foetid odour when recently cut. The Natal species is accordingly named Stinkwood. Then we have silk cocoons, tea from Assam plants, coal apparently of good quality from the interior, and sponges from the coast. Again, cheeses, hams, and wheaten flour; specimens of the botany in the shape of dried leaves and flowers, stems of tree ferns and other plants. The sugar cane is being exteusively cultivated, and some of the cultivators bave obtained the best machinery from England, and are turning out sugar of exeellent quality. Of the specimens here exhibited, that sent by Mr Atkinson of Isipingo, is the whitest; but Mr E. P. Lamports' contribution comes very near, (both have received prize medals), and other persons have sent clean nice samples. The arrowroot here shown is very white, and appears to be of a quality so good that we are surprised it does not command a higher price in the English market. Samples of maize, with its flour caked mealie meal, the earth nut that abounds with a useful oil, and eastor oil seeds may also be inspected. Several persons bave forwarded specimens of fair cotton, the largest sample coming from Mr Coquis' estate. To enable strangers to judge of the character of the scenery, a number of water colour sketebes hang on the walls of the court; and a good idea of the native ladies and gentlemen may be obtained from their photographs, from which we should not be inclined to rank their beauty very high, according to European notions. Specimens of the work of the natives are to be seen, principally articles of personal adornment. Contrasted with these is a model of that introduction of the colouist, his waggon, a structure well calculated to afford him protection against a burning sun, or a torrent of rain, and besides, if occasion need, to form a citadel within which he may fortify himself against attack. Lastly, we may mention that the nature of the climate is explained by some large diagrams that speak distinctly to the eye, and show the movements of the mercury in the thermometer and barometer, the quantity of the rain-fall, &c., at Maritzburg, which is 2000 feet above the sea. During the year 1861, it appears that the mean temperature of tbe summer months was about 68°, the highest day reading having been 89°, that during the three midwinter months the mean temperature was about 55°, the lowest reading having been 29°, three degrees below freezing point, whilst the daily rauge was sometimes more than 30°. The rain-fall for the year amounted nearly to 26½ inches. The mean temperature of Durban, on the coast, is about five degrees warmer than that of Maritzburg, which, however, is said to have greater heat and greater cold, in other words to have a greater range of temperature. We learn from Dr Mann's lately published appendix to his description of the colony of Natal, that the price of land in the colony has risen considerably within the last few years, especially in or near the towns, and rents have also risen in proportion. At Maritzburg patches of land about ten acres in extent, vary, accordingly to situation, from £150 to £1300; and stores command rents of from £150 to £250 a year, whilst for fair dwelling houses from £5 to £8 a month are obtained. Yet in this "city," as it is styled, there are only about 2340 white inhabitants. At Durban, the seaport, the corporation has come to tbe resolution of expending £50,000 in bringing in a supply of pure water, (at present water is procured from well's sunk in the sand, and is not of good quality), in hardening the streets of the town, (where people now sink ankle-deep in sand) and in forming a tram wad to a neighbouring stream called the Unageni. Collegiate institutions are to be formed, at the capital and the port. Three joint stock banks have been established, the oldest of which has paid as much as 25 per cent. to the shareholders in one year. A land and colonization company, with offices in London, has bought up several estates, and has advanced £38,000 at interest to colonists. Official returns showed that during 1861 goods to the value of £400,000 had entered the colony, and that the exported produce reached the value of £100,000.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING AUGUST 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	d.	£	s	d	£	s.	d.	£	s.	d.
Bars, &c., British, per ton,	5	15	0	5	15	0	5	15	0	5	15	0
Nail Rods,	7	5	0	7	10	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	15	0
Sheets,	8	10	0	8	10	0	9	0	0	9	5	0
Pig, No 1, Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	0	0	7	0	0	7	0	0
Rails,	5	7	6	5	10	0	5	10	0	5	10	0
Pig, No. 1, Clyde,	2	11	9	2	12	0	2	15	0	2	15	0
Swedish in bond,	11	5	0	11	15	0	11	15	0	11	15	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	16	0	0	16	0	0
In faggots,	18	0	0	18	0	0	19	0	0	19	10	0
SPELTER, ingot,	17	15	0	17	15	0	17	10	0	17	10	0
ZINC, sheet,	23	10	0	23	15	0	24	10	0	24	10	0
COPPER,												
Sheathing bolts, pr lb.,	0	0	11	0	0	10¼	0	0	10¼	0	0	10¼
Bottoms,	0	0	11	0	0	11	0	0	11½	0	0	11½
Old,	0	0	9	0	0	9	0	0	9	0	0	9
Tough Cake, per ton,	93	0	0	93	0	0	93	0	0	92	0	0
Tile,	93	10	0	93	0	0	93	0	0	93	0	0
TIN.												
Engli-h blocks, per ton, duty free,	116	0	0	116	0	0	114	0	0	114	0	0
Bars in barrels,	119	0	0	119	0	0	115	0	0	115	0	0
Refined,	119	0	0	119	0	0	119	0	0	119	0	0
Banca, in bond,	121	0	0	121	0	0	121	0	0	121	0	0
Straits, ditto,	114	0	0	114	0	0	114	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	2	6	1	2	6	1	2	6
LEAD.												
English pig,	20	0	0	21	0	0	21	5	0	20	10	0
Sheet,	21	0	0	21	10	0	20	10	0	21	5	0
Spanish pig, in bond,	19	10	0	19	0	0	19	5	0	19	10	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	3	15	0	3	10	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	15	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	10	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	10	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gotbenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	42	0	0	42	0	0	42	0	0	42	0	0
" yellow,	34	0	0	35	0	0	37	0	0	37	0	0
Sperm,	90	0	0	90	0	0	92	10	0	92	0	0
Cod,	39	10	0	40	0	0	40	0	0	40	0	0
South Sea,	36	0	0	37	0	0	37	0	0	37	0	0
Olive, Gallipoli, per tun,	56	10	0	57	0	0	57	6	0	57	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	49	10	0	50	10	0	50	0	0	50	0	0
Rape pale foreign,	52	0	0	52	0	0	52	0	0	53	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt.,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	35	0	0	35	0	0	35	0	0
Jute,	14	0	0	13	10	0	14	10	0	14	10	0
Hemp Rope,	23	0	0	24	0	0	21	0	0	24	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

8th July, 1862.

1966. John Rigby, Dublin—Guns and cartridges.
1967. O. W. Child, New York, U.S.—Shaft journal boxes.—A com.
1968. Joseph Bourke, 29th Regiment of Foot—Military accoutrements.
1969. Henry Wetbered, Bristol—Fastenings for doors and windows.

9th July, 1862.

1970. W. L. Wigginton, Hammersmith—Cure of smoky chimneys.
1971. J. M. Gille, Paris—Calendar inkstand.
1972. T. C. Gibson, Ramsey, Isle of Man—Ships and vessels.
1973. Alfred Gilbey, Oxford Street—Washing bottles.
1974. H. S. Poutifex, Banbury—Cleansing casks.
1975. Joseph Rhodes, Morley—Rag machines.—A com.
1976. C. F. W. Rust, London Wall—Concertinas.—A com.
1977. Hermann Eschwege, Miucing Lane—Purifying vinegar.
1978. G. T. Bonsfield, Brixtou—Washing machines.—A com.
1979. E. S. Hindley, Bourton—Warming dwelling houses and places.
1980. Thomas Green, Leeds, and Robert Mathers, London—Steam boilers.
1981. S. V. Evers, Lower Thames Street—Preparation of beverages.
1982. J. O. Butler, Leeds—Steam hammers.

10th July, 1862.

1983. W. F. Reynolds, Commercial Road—Watch pendant.
1984. Emile Jaudeau, Guilford Road, Brighton—Alcohols.
1985. Henry Kellogg, New Haven, U.S.—Fire arms and cartridges
1986. Joseph Mander, Birmingham—Crochet needles and holders.
1987. Ann Bonnell, Hethpool Street—Cburns.—A com.
1988. Joseph Ponti, Venice, Austria—Photographic pictures.—A com.
1989. E. J. Biddle, New York, U.S.—Coal oil as fuel
1990. Elmer Townsend, Massachusetts, U.S.—Making nails.—A com.
1991. John Leeming, Bradford—Jacquard machines.
1992. Daniel Steele, Bunhill Row, Finsbnry—Flushing water.
1993. Thomas Farra, Manchester—Wearing apparel.
1994. J. H. Johnson, Middlesex and Glasgow—Braiding machines.—A com.

11th July, 1862.

1995. J. R. Hill, Duke Street—Steam governor
1996. Matthew Cornall and Evan Griffiths, Manchester—Doubling and reeling.
1997. Joseph Waithman, Manchester—Carding.
1998. William Ashton, Manchester—Manufacture of "braids."
1999. John Orr, Glasgow—Weaving.
2000. James Miller, Lambeth—Steering ships.
2001. William Bliss, Chipping Norton—Heating ores.—A com.

12th July, 1862.

2002. C. E. Green, Blanford Street, and John Green, Edmonton—Fire-arms.
2003. J. P. Lees and John Beard, Ashton-nnder-Lyne—Carding engines.
2004. John Abraham, Birmingham—Shaping metals.
2005. Jacob Hunt, Preston—Sizing and drying yarns or threads.
2006. M. A. F. Mennons, Paris—Vessels as floating batteries.—A com.
2007. Thomas Hill, Great Warley—Protection of markers at rifle butts.
2008. E. T. Hughes, Chancery Lane—Winding silk thread on bobbins.—A com.
2009. J. H. Johnson, Middlesex and Glasgow—Washing ores.—A com.
2010. W. E. Gedge, Wellington Street—Hats.—A com.
2011. Pierre Plassan, France—An orthopedic apparatus.
2012. Daniel Bateman, Low Moor—"Card cloth."
2013. Henry Barber and Henry De Garss, Sheffield—Rolling metals.
2014. The Honourable W. E. Cochrane, Regent's Park—Railway fastenings.

14th July, 1862.

2015. Eliza Taylor, Regent Street—Buttons.
2016. George Lowry, Salford—Carding and cleaning cotton.
2017. W. E. Gedge, Wellington Street—Steam lift and force pump.—A com.
2018. A. A. Gannal, Paris—Bitnminous cement.
2019. C. and J. W. Crossley, Halifax—Washing and finishing textile fabrics.
2020. Samuel Partridge, Darlaston—Railway signals.
2021. P. and R. Sanderson, Galashiels—Woven fabrics.
2022. W. Gladstone May, Glasgow—Extending tables.
2023. P. A. L. Canonicat, France—Filtering water.
2024. George Fawcns, North Shields—Building boats.
2025. F. M. Parkes, Plumstead—Lighting and heating.
2026. O. P. Drake, Massachnsetts, U.S.—Vaporizing liquid hydro-carbon.
2027. Robert Ridley, Morlin, and J. G. Jones, Battersea—Ventilating mines.

15th July, 1862.

2028. Alexander Leslie, Turriff—Steam cultivation.
2029. Alphonse Convrenx, Paris—Breaking stones.
2030. John Green, Newtown—Signals.
2031. Alphonse Convrenx, Paris—A centrifugal apparatus.
2032. Edward Draper and Edward Thomas, Birmingham—Shutters and doors.
2033. William Dickens, Salford, and John Hewitt, Manchester—Spinning mnles.
2034. C. E. Crawley, and Frederick Foster, City Road—Safety lamps.
2035. T. G. Ghislin, Hatton Garden—British and foreign algæ.

16th July, 1862.

2036. Bryan Johnson, Chester, and E. H. Taylor, Coed Talon—Rope wheels, cages, and tanks.
2037. G. T. Selby, Smethwick—Superheating tubes.
2038. L. R. Bodmer, Holborn—Winding up watches.—A com.
2039. William Henson, Nottingham, and W. W. Clay, Sneinton—Knitting.
2040. A. V. Newton, Chancery Lane—Sewing machines.—A com.
2041. Charles Sanderson, Sheffield—Crinoline steel.
2042. Robert Dunn, Newcastle-upon-Tyne—Furnaces.

17th July, 1862.

2043. Manilias Kurts, Bishopsgate Street Without—Handles for nmbrellas.
2044. James Dickson, Tollingtou Road—Caustic soda.
2045. Henry Appleby, Plumstead—Armour plates.
2046. J. G. Harkness, Birkenhead—Safety handle for winches.
2047. Joseph Schloss, Canon Street—Pouches.

2048. T B. Daft, Queen Square—Mats.
2049. T. B. Daft, Queen Square—Vulcanized India rubber thread.

18*th July*, 1862.

2050. William Gossage, Widnes—Compounds of soda and potassa.
2051 Joseph Willcock, Chancery Lane—Ornamental fabrics.- A com.
2052. O. F. Morrill, Massachusetts, U.S.—Generating heat for culinary purposes.
2053. F. L. Stott, Rochdale—Warping yarns or threads.
2054. J. R. Abbott, Birmingham—Gasaliers and lamps.
2055. J. S. Jarvis, Wood Street—Shirt collars.
2056. R. A. Brooman, Fleet Street—Generating heat in furnaces.—A com.
2057. C. A. Day and Thomas Summers, Southampton—Sheer legs.

19*th July*, 1862.

2058. A. B. Brown, Stockport—Steam engines and boilers.
2059. G. J. Yates and J. W. W. Tindall, Liverpool—Deodorizing paraffin coal.
2060. Robert Barrett, Stepney—Dampers of steam engine furnaces.
2061. R. A. Brooman, Fleet Street—Revivifying animal black.—A com.
2062. Alphonse Cotelle, France—Alcohol.
2063. Alfred Pratt, Wandsworth Road—Self-capping fire arms.
2064. W. E. Newton, Chancery Lane—Ordnance and projectiles.—A com.
2065. W. E. Newton, Chancery Lane—Preparing fibrous substances.—A com.
2066. T. H. Saunders and Joseph Millbourn, Dartford—Paper.
2067. William Tranter, Birmingham—Fire-arms.

21*st July*, 1862.

2068. Charles Ramsay, New Bond Street—Military cloaks.
2069. J. W. Green, Little Carter Lane—Cutting glass —A com.
2070. Ernest Bazin, France—An electric railway carriage signal.
2071. W. E Gedge, Wellington Street—Boring apparatus.—A com.
2072. Thomas Davey, Tuckingmill—Gunpowder.
2073. A. M. Fell, Anchanhard—Sulphate of ammonia and manure.
2074. Andrew Nandain, James Peacock, and W. H. Walton, all of the States of America—Looms for weaving textile fabrics.
2075. William Clark, Chancery Lane—Pomade or balsam.—A com.
2076. Andrew Phillips, Glasgow—Looms for weaving figured fabrics.

22*d July*, 1862.

2077. Thomas Meriton, Hamburgh—Steam engine governors.
2078. Simeon Lord and John Lord, Facit, near Rochdale—Carding engines.
2079. P. F. Cassegrain, Paris—Fire-arms.
2080. Auguste Fournier, Maddox Street — Easy chairs, carriage seats, &c.
2081. William Smith, Over Darwen—Power looms for weaving.
2082. Joseph Daniels, Leigh—Artificial manure.
2083. Roderick Grogan, Bayswater—Increasing the speed of steam vessels.
2084. W. E. Gedge, Wellington Street—Marking wadded stuffs.—A com.
2085. William Crofts, New Lenton—Manufacture of fabrics.
2086. H. R. Summons, Dalston Road—Bordering envelopes, paper, and cards.
2087. H. R. Summons, Dalston Road—Bordering envelopes, paper, and cards.
2088. Thomas King, Spitalfields—Measuring malt and grain.
2089. George Payne, Grantham—Horse shoes.
2090. J. H. Johnson, Middlesex and Glasgow—Treatment of noxious gases produced in the distillation of tar.—A com.
2091. A. C. Vautier, Paris—Paper pulp, fibrous materials, and textile fabrics.
2092. J. J. Haley, King Street—Washing, wringing, and starching clothing.

23*d July*, 1862.

2093. C. J. Keene, Bayswater—Raising and lowering canvas on easels.
2094. Zerah Colburn, Tavistock Street—Condensation of steam.
2095. E. K. Dutton, Stretford—Steam engines.
2096. Alphonse Vignon, Southampton Buildings—Extinguishing fires.
2097. William Clark, Chancery Lane—Manufacture of manure.—A com.
2098. Emile Alcan, Coleman Street Buildings—Carding wool.—A com.
2099. Robert Bell, Dublin—Manufacture of bricks.—A com.

24*th July*, 1862.

2100. James Leetch, St Marylebone, and Brownlow Mathew, St James'—Protecting ships' bottoms and steam boilers.
2101. James Dickson, Tollington-road—Treating copper ores.
2102. John Horton, Birmingham—Breech-loading fire arms.—A com.
2103. William Clissold, Dudbridge—Manufacturing cylinders.
2104. Henry Rawson and Frederick Staples, Leicester—Combing wool.
2105. Toussaint Lemaistre, Paris—Improvements in privies.
2106. J. G. Clarke, Brackley—Improvements in scythes.
2107. W. H. Perkin, Seymour Villa, Sudbury—Printing and dyeing, and preparing colouring matters.—A com.
2108. William Clark, Chancery Lane—Fishing and other nets.—A com.
2109. Michael Henry, Fleet Street—Retarding railway carriages.—A com.

25*th July*, 1862.

2110. H. A. Jowett, Sawley—Obtaining motive power.
2111. J. Redgate, Swinton, and H. Redgate, Nottingham—Manufacture of fabrics.
2112. James Anderson, Allan Bank, Perthshire—Separating gluten from starch.
2113. Peter Robertson, Glasgow—Producing frictional surfaces.
2114. William Clark, Chancery Lane—Decanting wine.—A com.
2115. James Seymour, and D. G. Hatcher, Southampton—Steering ships.
2116. William Clark, Chancery Lane—Rafts for inland navigation.—A com.
2117. Vicenzo Manzini, Modena, Italy—Locomotive engines.
2118. Ebeuezer Comfort, Camberwell—Watch protectors.
2119. Adolphus Lahousse, Brussels—Railway wheels.
2120. Ephraim Tysall, Riding House Street—Manufacture of forks.

26*th July*, 1862.

2121. Thomas Sagar and John Rocliff, Burnley—Moulding.
2122. A. V. Newton, Chancery Lane—Attaching armour plates to ships.—A com.
2123. William Clark, Chancery Lane—Extracting silver from ores.—A com.
2124. J. H. Selwyn, Grassmere—Paying out and raising telegraph cables.
2125. Thomas Long, Clarendon Place—Manufacture of open metal work.
2126. Robert Low and William Duff, Dundee—Producing an adjustable pressure on certain parts of machinery.

28*th July*, 1862.

2127. Joseph Walton, Strand, and James Moore, Upper Berkeley Street—Ventilating and heating buildings.
2128. Henry Bollinger, Stockton-on-Tees—Ship building.
2129. C. W. Eddy, Belgrave Road—Impeding a channel against vessels.
2130. William Speuce, Chancery Lane—Red colouring matter.—A com.
2131. P. S. Devlan, Manchester—Telegraphic cables.
2132. William Spence, Chancery Lane—Blue colouring matter.—A com.
2133. T. A. Favrichon, France—Heating baking ovens.
2134. William Maugham, Wandsworth Road—Effervescent beverages.
2135. Thomas Cook, Walworth—Manufacture of envelopes.
2136. Alfred Noble, Bristol—Treating compounds of alumina.
2137. Joseph Fourdrinier, Peckham—Removing knots from pulp.
2138. John Ellis, Kingston-upon-Hull—Washing grain.
2139. Fraser Selby, Surbiton—Surface condensers.
2140. Henry Hedgely, Great College Street—Lamps.
2141. Edmund Burnett, Ashford—Combined cart and sleigh.
2142. J. L. Jullion, Gateshead-on-Tyne—Antichloride for paper making.
2143. C. W. Siemens, Great George Street—Gas engines.

29*th July*, 1862.

2144. Rosewell Thompson, Boston—Sewing machines.
2145. Zerah Colburn, Tavistock Street—Steam pumping engines.
2146. James Mackenzie, Arundel Square—Curvilinear shaping machines.
2147. Arthur Boyle and Thomas Warwick, Birmingham—Umbrellas and parasols.
2148. E. T. Hughes, Chancery Lane—Refining slag from furnaces.—A com
2149 P. S. Devlan, Manchester—Composition for covering projectiles and vessels
2150. James Norris, Great Russell Street—Construction of ovens.
2151. C. T. Burgess, Brentwood - Stand for casks.
2152. George Waldie, Linlithgow—Colour printing.
2153. James Mapple, and Daniel Mapple, London.—Telegraphic apparatus.
2154. E. B. Clark, St Ewe, Coruwall—Manufacture of candles
2155. Michael Henry, Fleet Street—Fibrous materials and paper pulp.—A com.

30*th July*, 1862.

2156. George Nock, Brierly Hill, Stafford—Self-acting crossing railways.—A com.
2157. F. C. Warlich, Alma Terrace—Dressing and shaping stone.—A com.
2158. W. E. Gedge, Wellington Street—Securing the safety of trains.—A com.
2159. Joseph Hyde and Jessia Hyde, Bradbury—Steam governors.
2160. Benjamin Bailey, Leicester—Cutting chaff.
2161. Horatio White, Hampstead Road—Shirt collars.
2162. William Wanklyn, Bury—Opening compressed cottons.
2163. John Benyon, Swinton—Looms for weaving.
2164. G. H. Birkheck, Chancery Lane—Preserving timber.—A com.
2165. William Clark, Chancery Lane—Gas burners.—A com.
2166. Thomas Holt and F. L. Stott, Rochdale—Composition for protecting iron.
2167. William Norman, Manchester—Tables and drawers.
2168. J W. Dixon, Sheffield—Coffee urns.
2169. J. W. Woodford, Sutherland Street—Raising water.

31*st July*, 1862.

2170. E. F. Prentiss, Birkenhead, and R. A. Robertson, Liverpool—Distillation.
2171. William Weild, Manchester—Cutting, rolling, and fluting metals.
2172. J. & E. Ransom Kempston—Mounting mill-stones.
2173. Caleb Bedells, Leicester—Manufacture of Braces.
2174. G. T. Bousfield, Brixton—Fluids for burning in lamps.—A com.
2175. A. V. Newton, Cnancery Lane—Planing metal.—A com.
2176. W. E. Newton, Chancery Lane—Lubricating compounds.—A com.

1*st August*, 1862.

2177. James List, Isle of Wight—Obtaining distances and heights.
2178. John Sinclair, Glasgow—Ventilating and fumigating.
2179. D. T. Lee, Birmingham—Ornamenting wood and papier maché.
2180. G. Hazeltine, Fleet Street—Gunpowder, and granular substances.—A com.
2181. G. A. Biddell, Ipswich—Railway crossings.
2182. J. C. Onions, Birmingham—Portable forges.
2183. Robert Nurse, Machen, and David Nurse, Pontymister—Annealing pot.
2184. J. E. Marsh, Birmingham—Metal rivets.
2185. C. H. Slevins, Dunston Hall, and Henry Rider, Rotherham—Colliery waggons.
2186 W. E. Newton, Chancery Lane—Projectiles and sabots.—A com.
2187. T. G. Wehh, Manchester—Flint Glass.

2*d August*, 1862.

2188 Thomas Onion, Calais—Steam engines and propellers.
2189. James Briggs, Blackley—Belts, tapes, laces, &c.
2190. James Gray, Glasgow—Cleaning ships' bottoms.
2191. E. B. Wilson, Parliament Street, and Maurice Picard, Lyons—Iron and steel.
2192. Charles Warne, Tyleham Mills, near Scole—Linen arabbett.
2193. George Coles, Gresham Street West, J. A. Jaques, and J. A. Fanshawe, Tottenham—Polishing tools.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 17th May to 14th August, 1862.

May	17,	4483	Richard G. Coles, Fleetwood—"Target for Percussion Cap Practice."
June	3,	4484	Commander Hay, R.N., & J. R. Stebbing, F.R.A.S., Southampton—"A Compound Protractor."
,,	4,	4485	Robert and Edward Furness, Trump-street, City, E.C.,—"A Compound Collar and Cravat, to be called the 'Olympic.'"
,,	5,	4486	Richard Madeley, Birmingham—"A Flooring Cramp."
,,	10,	4487	James Ashburner, Lieut. 1st Cheshire Engineer Volunteers—"Reversible Target."
,,	14,	4488	Allen and Felton, Birmingham—"Perpetual Calendar for Articles of Jewellery."
,,	18,	4489	R. K. Day, Aldermanbury, E.C.—"Tournure or Crinoline."
,,	20,	4490	Farrow and Jackson, Great Tower Street, E.C.—"A Screw Bottle Stopper."
,,	28,	4491	W. H. Blanch, Liverpool—"Wind Gauge Rifle Pore Sight."
,,	30,	4492	W. C. Edge, Owen's Row, St. John Street Road, Clerkenwell—"Fastening for securing Scarfs and Handkerchiefs."
July	7,	4493	T. K. Mace, Bull Street, Birmingham—"Hat Suspender or Miscellaneous Clip."
,,	12,	4494	Christian Weinhand, jun., Offenbach-on-the-Maine—"Fastening for Porte-monnaies and other cases."
,,	17,	4495	Henry B. Harris, Birkenhead—"The Concavoterminal Cigar."
,,	19,	4496	William Orth & Co., Chiswell-street, E.C.—"The Lever hinged Bag Frame."
,,	,,	4497	William Oxley & Co., Manchester—"Steam Trap."
,,	22,	4498	Joseph Orchard, Birmingham—"Sugar Tongs and Cutter."
Aug.	8,	4499	Samuel Walker, jun., Birmingham—"Cornice Pole and Curtain Rod."
,,	9,	4500	Messrs Herrington and Hall, Clerkenwell, E.C.—"Instrument for finding the Centres of Ovals and Circles, and dividing them into equal parts."
,,	11,	4501	Samuel Phillips, Birmingham—"Fastening for Brooches, Pins, Links, and Articles of Jewellery."
,,	14,	4502	Thomas Wilson, Birmingham—"Screw Wrench or Spanner."

PROGRESS OF THE EXHIBITION.

ART. V.

No further back than the middle of July last, the awards of the juries were delivered, in duly printed form, with much peripatetic solemnity, at various "stations" within "the building"—to whom, was not quite clear, nor was "the ceremony," in its processional pilgrimage to "the stations," quite free from the old touch of the ludicrous, though an improvement on the opening proceedings. Copies of the printed awards were then promised to all the jurors. None, however, were forthcoming for them, unless on payment of five shillings, at which rate they were plentifully on sale in the building. It is now September, but, to this hour, the promised copies of the awards have never been distributed to the jurors; nor, personally, have we ourselves been able to obtain any official intelligence, on more than one application, as to when they may be so.

In the interval, however, no less than three new announcements have been made; in their order, a climax of singularity, to say the least of them. First, "the delivery of the medals and certificates of honourable mention cannot take place until after the close of the Exhibition, when it will be made at a public ceremony;" and then follow the terms upon which the Commissioners will permit the same to be "on view." In this, they follow up the course that, from the outset, has degraded their own office—noble and exalted as it should have been—into that of mere greedy proprietors of an exhibition—a show—out of which the most possible, is to be got. With what other conceivable aim or object, than to make the opportunity for two profit-winning galas, in place of one, has the production and delivery of the medals been kept back and dissevered from that of the awards that adjudicated them. It will not be denied that the *proper time*, for the actual decoration of the medallists, was when the awards were declared; nor is there any man of discernment and taste, but must feel that, in not being *then* delivered to the rewarded exhibitors in person, or to their representatives, almost everything that could add formal weight to the judgment, and give dignity to the rewards conferred, has been permanently lost. By splitting, what always ought to have been one ceremony, into two, each has become as unbalanced and incomplete, as an odd blade of a pair of scissors. In this, the Commissioners have been true to the instinct of money-getting; but not, in our judgment, to their primary duties.

The second announcement, of the 15th of last month, headed, "Reports of the Juries," informs the public that "the Council of the Society of Arts *have felt the importance* of having some permanent and authoritative record of the International Exhibition;" and finding that Her Majesty's Commissioners have provided only for the publication of the awards, they, the Council of the Society of Arts—have, in short, undertaken the matter,—and have placed it in charge of Dr Lyon Playfair, the Special Commissioner of Juries. There is something *naive* in the admission that the Council of John Street Adelphi, *does* feel the importance of having *some* permanent and authoritative record, of the Exhibition, while admitting, that the Commissioners themselves are dead to any such feeling, or, if feeling its importance, have "not provided for it." We shall be curious to see, however, what sort of permanent and authoritative record can be produced by this vicarious process, due to the feelings of the good Samaritans of the Adelphi. It was announced that these reports were to have been published during "the present month," i.e., in August last. The month hath fled, and with it that first promise at least. Permanent, perhaps the volume may be, so far as the super-royalty of the octavo, the cloth, the gilt edges, and the "suitable binding in morocco," can make it; a well-put-together and handsome-looking volume, and, probably, as readable, as the undoubted ability of Dr Lyon Playfair may produce, out of the heterogeneous mass of materials that it will be his task to work upon; but, authoritative, no. In what possible way can it be authoritative in the only sense here in which the word can be coupled with a truth?—authoritative, as being authorised by the Society of Arts, and authored, by Dr Playfair; but, not authoritative, as being the jointly-made and solemnly-voted and consented-to, reports made and presented by each jury, through its own officer, and for itself. What are the facts? As long ago as May or June last, the several juries were informed, not by any proper formal document, but verbally, through their several "special commissioners," that it was "very doubtful" whether the Royal Commission would publish any reports; and the pulses of the juries were then felt, as to whether they would be prepared to co-operate in the scheme now in action, for throwing their duty overboard on the part of these, the alone proper officers, and letting the Society of Arts step in, as volunteers, for a consideration, to do it for them. The juries (some, at least, to our own knowledge) were informed, that no steps could be taken as to this, indeed no decision come to on the matter, until after the 15th June; when the functions of every jury would have ceased, the foreign jurors have, in great part, left London, and jury officers and jurors, have got completely scattered. We believe the prevalent feeling amongst the juries was the same as that, which dictated a distinct decision in some at least; that under such conditions, they could not feel justified in attempting to make a report, which must be, necessarily, written by some one person, whose production could never be submitted to the criticism, revision, assent, or sanction of the jury, which, as a body, would have already ceased to exist; and which report must, therefore, be no more than the *ex parte* and unauthenticated statements, of an individual member, for which no jury could be expected, least of all thus, by anticipation, to hold itself responsible.

What influences have since been brought to bear, that may have changed those views, on the part of some complacent chairmen or officers, or members, of juries, we know not; nor who the individual gentlemen may prove to be, who have undertaken to become the mouthpieces of their several juries; but this is obvious, from what we have stated, that however meritorious, able, luminous, and true, may be their literary productions, or, however wanting, in one or all of these qualities, *they will not be what they are avowed to be*, "*Reports of the Juries.*" They will not necessarily express, the formally-arrived-at, united mind, of each, or of any jury; and whatever may be the nature of their statements, it is competent for any juror to repudiate them as for himself; and to deny that, in any one instance, a single jury can be held responsible for any one statement in the book, nevertheless, to be ushered into the world, as the "Reports of the Juries."

Thus, to escape, an obvious, paramount, and peremptory duty, devolving properly on the Commissioners, and for which adequate men and machinery should have been provided, in early and proper time, namely, while the juries were yet *in esse*—and to evade its cost, by throwing it over to the Society of Arts—the Royal Commissioners have made themselves parties to conniving at the deception, by which this collection of individuals essays, is surreptitiously brought before the world, as the authorised reports of the juries. To answer justly to such a title, these reports should each have been made, while all the juries were yet sitting,—should have been, when completed, finally read, and formally passed by vote, in each jury. They would then, and not before, have been authorised by the juries,—the first and most important *bodies* whose authorization, the world has a right to demand. They should then have been published, by the Royal Commissioners for the Exhibition, whose sole authority for the authenticity of the reports, it has an equal right to require.

But they have got neither the one nor the other; and what, we may well ask, is the Society of Arts, that it should thus place itself in the position of usurping the functions, both of juries and Royal Commissioners—a body with no more weight or responsibility in the matter, than would any large speculative printer in London possess, if employing an equally able chief-editor, he had thought "it would answer his purpose," as a volunteer, to publish a report of the juries, and call it authorised.

The third announcement, since the publication of the awards, is, however, the climax in singularity and unseasonableness of subject. It emanates from the Council of the Society of Arts—the body thus closely allied, almost suffered to become identified, as to these awards and

rewards, with the Commissioners themselves—and is to the following effect:—

AWARDS OF MERIT.

The following circular has been issued; a copy will be furnished to any exhibitor on application to the Secretary of the Society of Arts.

Society for the Encouragement of Arts, Manufactures, and Commerce,
John-st., Adelphi, London, W.C., Aug., 1862.

Sir,—The Council of the Society of Arts have decided to invite the opinion of the Jurors, the Commissioners for the Colonies and for Foreign Countries, and the principal exhibitors at the International Exhibition, on the question of Awards of Merit in connection with International Exhibitions; and I am directed by the Council of the Society of Arts to transmit to you the accompanying queries, with a request that you will favour them with your views on the subject, it being the intention of the Council to embody the answers they may receive in a public report:—

1.—Are you of opinion that awards for merit, by medals or otherwise, in International Exhibitions, are desirable?

2.—State the reasons for your opinion.

3.—Ought works of Fine Art and Designs to be excluded from the awards?

4.—Can you suggest any better method than the appointment of jurors for making the awards?

5.—Can you suggest any improvement in the constitution or proceedings of the juries?

6.—Is any appeal from the decision of juries desirable?

7.—If you think awards undesirable, can you suggest any other means by which meritorious productions may be brought to the notice of the public?

8.—Have you any further suggestions to offer on the subject?

It is particularly requested that any replies with which you may favour the Council may be sent not later than the 15th of September, and that they may be written on foolscap paper, on one side only, with an inch margin, and numbered corresponding to the number of the questions.—I am, Sir, your obedient servant,

P. Le Neve Foster, *Secy.*

Thus, within six weeks of the publication of the jury awards, of 6992 medals, and half as many more "honourable mentions"—and while as yet the medals themselves, are invisible and undistributed—the question is gravely put, to all those who did, and who did not, get medals, whether they think it desirable to give any medals at all! In the document itself, we may just remark, there is that slovenliness of expression, that often marks inaccuracy of thought. For example, under No. 2 there is put, as though it were another head of enquiry, what, the addition of the words, "and why?" to number one, would have fully supplied.

No one, however, can decline assenting to the importance of the general enquiry to which these questions refer, especially with the accumulating evidences of the slovenly neglects, mistakes, and oversights, appearing amongst the decisions of the juries, and the still larger crop of supposable ones that have not yet come up to day, and many of which, for divers good and sufficient reasons, never will be known. Only, might it not have been less of ὑστερον πρωτερον, to have settled these questions before June last, when they were acted on as decided already; or, if still to be discussed, to have waited until that decision had been fulfilled by the delivery of the medals, etc.

We make no moral accusation against the juries, composed as they were, in good part, of the best intellects, and amongst them some of the noblest hearts in the world,—very far from it; but while we know, how laboriously and zealously some did their duty, and can believe, more or less, the same of all, we also know, that, for want of other arrangements than those that existed, it was utterly *impossible*, but that injustice must have been done and mistakes committed in many quarters.

To such, and to these unhappily timed and misgiving questions, of the Society of Arts, we purpose returning.

THE INVENTION OF THE STEAM HAMMER.

Probably no metal working tool, has ever been invented, that has produced such remarkable effects, upon many distinct branches of manufacture, fabricated in iron and other materials, as the steam hammer. It came so opportunely, so rapidly and naturally wedded itself, to several classes of works, already on the confines of progress, and, as it were, waiting for it, that its powerful effects upon their development, have been very much unfelt, by even the generally well informed, and are only fully known and understood, by those whose practical opportunities of observing, and knowledge of the historical past and present, of mechanical arts, have enabled them palpably to realise the enormous powers, that directly and indirectly the steam hammer has conferred upon mankind.

There is nothing of exaggeration in affirming that the developments, both in magnitude and number, of iron shipping and of marine propulsion, have been greatly dependent upon this tool, without which stern posts and keel slabs of forty tons weight, paddle and screw shafts of twenty-six inches diameter, double cranks, such as those of the Great Eastern, could only have been forged, if at all, with a difficulty and imperfection amounting practically to impossibility.

The Lancaster shell—all the forms of wrought iron and steel guns—owed their possibility to the steam hammer. Railway wheels, in numerous forms, and especially those so common in Germany, though so little known amongst ourselves, namely, of puddled and cast steel, forged in one piece at one operation, owe their birth to it; and without it the amazing development of the Cast Steel Industry of Westphalia would be now in about the same state that it was left in Styria in the days of Von Mitis, a quarter of a century ago; and, moreover, without the steam hammer, with its huge ope of jaws and long blow, could never, in *any length* of time, have been brought to what it is now. Examples innumerable might be adduced of its effects upon other manufactures and arts; how it has become the great tool of the coppersmith, has been heard in the wild "diggings" of Australia, and on the Sacramento, as a quartz crusher, and given to the civil engineer an instrument for pile driving, that has contracted into days, the previous task of months.

The early history of such a tool well deserves precise record, while yet the facts are fresh and known; not alone, as material for the future historian of human progress, but as rendering just homage, to those who have conferred this increased power upon our race.

Some time since, in preparing to write the article on tools for the *Exhibition Record* of this *Journal*, we wrote to our long respected friend, Mr James Nasmyth, asking him to favour us with such early particulars, as he could call to mind, of his invention of the steam hammer, with a view to publication. We received from him the following letter, the chief *facts* of which, as to date principally, we have alone been able (through restricted space) to print in the *Exhibition Record*; the whole document, however, may be considered an historical one, and as the circumstances have not that we are aware of, been fully published anywhere previously, we transcribe it here in all essential respects:—

Penhurst, Kent, Aug. 22, 1862.

My Dear Sir,—I hasten to reply to yours, asking for some particulars respecting my steam hammer, more especially how I came to think of it. I should, indeed, feel much gratified by any notice that you might think proper to take of my steam hammer, the glory of which has been almost entirely eclipsed by the results of its now almost general use; but to those who can dig down into first causes, I trust my suggestion will be found to lie at the root of much that is giving a special character to the mechanical features of the time; but it is not for us to glorify ourselves; only, I can say with some pride, that I feel I have, in that respect, helped mankind to a very useful agent, in introducing the application of one of the most valuable materials employed in the mechanical arts. I am only in the position of the man who blows the bellows for the organist: it's a case of WE did it. The history of the invention of the steam hammer, so far as I am concerned with it, is this. What first set me a thinking on the subject was the receipt of a letter, on Sunday morning, the 23d November, 1838, from my friend Francis Humphrys,* then residing at Bristol, as engineer to the Great Western Steam Ship Company, and engaged in the design and execution of the trunk engines, which he had designed for that vessel. The purport of the letter in question was to tell me he had encountered a very unexpected difficulty in the execution of the engines, namely, that there was not a forge hammer in England fit and powerful enough to execute the paddle shaft of his engines, which at the largest diameter was upwards of thirty inches. He wished me to say, whether or not, in this emergency, I thought he might have recourse to cast iron? for none of the forge proprietors he had applied to would undertake so large a forging as he required. As in many such cases, the very asking me such a question, and placing before me the nature of the difficulty, set me a thinking on the subject; and, in this case, as in many such ones, ideas ran on very fast. I saw that the cause of the difficulty lay in want of compass or range of blow in forge hammers, as usually constructed, the result of too close an adherence to the old traditional ideas of a hand hammer (⊣); and that, as the essential constituents of a hammer were only a mass of matter lifted up and let fall upon the object to be hammered, all that

* Late elder brother of Edward Humphrys, Esq., of the firm of Humphrys and Tennant, Marine Engineers, Deptford.

was wanted to constitute a hammer was a block of metal, with the lifting power brought into the most direct connection with it. I don't think I was five minutes in having it all clear before my mind's eye; and taking pencil in hand at same time, I soon saw it before me, as in fig. 1. A, anvil; B. work to be hammered; C, the block of metal to give the blow. Then I had, as in fig. 2, A B C with the simple and direct union of the lifting power supplied by the steam cylinder, D, to which piston rod the hammer block, C, is directly attached, and the two side standards, E E, to support the cylinder, and guide the hammer block in its up and down motion. *You* know how rapidly one's mind runs through the details of such arrangements. I am certain five minutes was more than ample to yield me a mind's eye view of the whole, and the pen did the rest. The first practical difficulty that presented itself to my mind was the destructive effect of the momentum of the piston and piston rod on its junction with the hammer block: this I at once met with *cartilage*, viz., an elastic or yielding substance below the end of the piston rod, so that the momentum of these parts might be received on an elastic or slightly yielding resistance. I had the whole so clear before me, that I wrote to F. Humphrys by that post, with sketch of what I proposed as the plan of forge hammer that would be able to execute his shaft. He was delighted with the sketch, and showed it to Brunell, who was much struck and pleased with it. I told them they were at liberty to adopt it if they thought proper, the only condition was that I should make the first one. About this time, Brunell was taken with the idea of adopting the *screw*, in place of the paddle wheels, for the *Great Western*, and the big shaft and the engines were shelved, till Brunell had made up his mind on screw *v.* paddle wheels. The conclusion, etc., arrived at was, "to adopt the screw," so poor Humphrys' trunk engines, which were in full progress, and on which he had built his hopes for fame and fortune, were set aside, and as no big shaft was wanted, my proposed steam hammer was shelved also. They contrived to break poor F. Humphrys' sanguine heart, and his death from fever too soon followed. I then felt so wishful to see my steam hammer at work, that I wrote to Acramans, Morgan & Co., to beg that they would let me make one for them, and they might have half the patent if they would but give me an order, and so enable me to get *my* partners to supply me with the means to patent it, which they at that time declined to do, as times were very bad, and *severe* economy the rule of the day at Patricroft. Morgan declined to have a steam hammer, preferring to put up a sort of stamper on his own plan, namely, a flat rod, with a block at the end raised by two nipping rollers, o o, as in fig. 3, so I was shut out of any prospect there. I then offered it to Messrs Howard & Ravenhill, they to have the patent if they would but give me an order, and let me have the pleasure to see

Fig. 1.

Fig. 2.

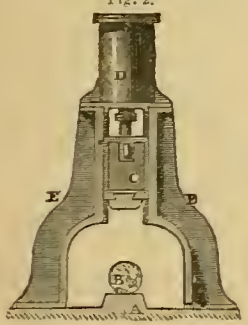


Fig. 3.

Fig 4.

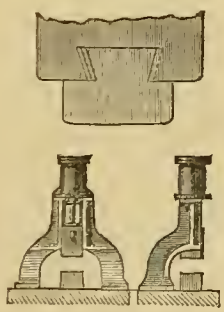


Fig. 5.

my hammer in actual work. Bad times, and more hammers than they found use for, was their reply. Shut out again, I next applied to T. L. Rushton, of Bolton. This was in 1839; he laid my plans and designs before Ben. Hick, of Bolton, who much admired the design, and gave such an opinion on it, as very nearly led Rushton to take it up. But, as before said, the times were then so bad, that his forge works were next to standing still for want of orders, so he wrote to me, that on that account *only*, he must let my proposal stand over. It was about this time that M. Schneider and M. Bourdon, of Creusot, France, visited our works to order some tools, and, as an act of civility to them, in my absence, my then partner, Gaskell, opened my scheme-book, which lay in the office, and showed them, among other "notions" of mine, my sketch of the steam hammer; they were much struck with the design, especially Bourdon, who was a first-rate mechanic; and as there was no patent in the way, and my design had been shown to many in the hope of getting an order, the fact of their having seen the design under these circumstances induced them to take the matter up, but without any communication with me as to their intention to do so. I continued almost "hawking" my scheme about, I was so wishful to see it carried out; but no orders could I get for it, and my partners were averse to lay out money on "schemes." In the early part of 1842, I made a tour through the arsenals of France, at the request of the Minister of Marine; in the course of my journey I visited the works of Messrs Schneider & Bourdon, at Creusot. Schneider was absent, but Bourdon was there; while waiting for him in the yard, I observed some wonderfully clean forgings of cranks, with the eyes evidently punched. When Bourdon came to me (I had never seen him before) I remarked to him about the execution of these forgings; said he, "They are done with your steam hammer!" You may imagine my surprise, and, I may say, satisfaction. "Come this way, and you shall see it" He took me to the forge, and there sure enough was my steam hammer! He then told me of the visit to Patricroft, and of Gaskell having shown him my designs, and of his having set to make one on his return to Creusot, and his high satisfaction with its action. I wrote by that post to my partners, telling them that my design was no mere scheme now, but a realised success, and that, in justice to me, they must either supply the means of securing the patent for our joint profits, or allow me to get some personal friend to supply the means. This latter they agreed to, and my brother-in-law, Wm. Benuett, advanced the cash required for the patents, he to be reimbursed before any division of profits, and then to have one-sixth. I returned home soon after, and secured the patent, dated, I think, June, 1842. I was not long in having my hammer at work, and its own intrinsic merits soon led to its pretty general introduction. The United States' patent was secured by Messrs Merrick and Son, of Philadelphia, on our behalf, they to manufacture and pay a royalty, which they faithfully performed to the last. The next patent was for my steam pile driver, in which the main feature was, the placing the steam hammer part of the apparatus on the shoulders of the pile, and so letting it go down along with it, thumping all the way. This was very successful also, and has importantly aided in carrying out every great work. Several other improvements were made in the steam hammer, in respect to self-acting motion—the employment of steam on the upper as well as under side of the piston, for hammers of rapid motion, patented also by our late Mr Thomson, with thick piston rods and other such improvements. There are many steam hammers now before the world, but amazingly few, if any, with any claim to originality, for all such are mere varieties of my own patented inventions. It is singular to me how close they all keep to the original, even in details, my plan for forming the hammer and anvil face, by a dove-tail and wedge, with slip of wood to allow for compression, as in sketch, fig. 4, in almost all of them; and the original form, (fig. 5,) is, in like manner, become quite traditional; "Rule Britannia," with a note or two added, or taken away, but still the old air very distinct. I am quite amused at the mention of *New Patent Steam Hammers*—they are legion; but the parent features are very strongly marked in all. There are many small particulars that I could add to this narration; but I must not fatigue your valued patience with such. What I have given is, I fear, too prolix already; but it is, so far as it goes, an honest, candid narration of the history of my inventorship of the steam hammer. You can use your own good judgment as to the publication of all, or any part or portion that will serve your purpose. Should you have any further questions to put to me, in regard to this subject, I shall be most happy to reply to the best of my ability. So important are the *results of the use* of the steam hammer, that, in that respect, all details of the narration of its history are interesting, or may be, some day.

Pray pardon an old schemer for his prolix garrulity, and, believe me, I am, yours very faithfully,

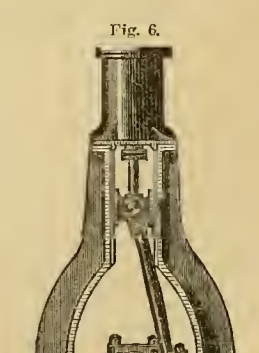
JAMES NASMYTH.

To R. MALLET, ESQ., C.E., *London*.

P.S.—In 1849, I designed a form of steam engine, founded on the arrangement of my steam hammer, as shown in fig. 6. This has been very generally adopted by various engine makers, and is found very satisfactory, especially for screw vessels.

I forgot to say that I have no wood-cut of my steam hammer, nor do I know of any such extant. The only authentic engraving of it is that in Messrs Blackie & Sons' work, which they published in the style of that of M. Armengaud. My steam hammer has been left to fight its own way into general use, with, so far as I am concerned, an unusually small amount of "cracking up."

Fig. 6.



It may seem a rather odd comment upon this letter of Mr Nasmyth, to add, that he was not the first inventor of the steam hammer; yet such is the fact. As an original invention, the steam hammer dates back to June, 1806, when it was made, and for any information to the contrary as yet known to us, first made, by William Deverell, an engineer of London; and uot only invented, but patented, as the following specification proves.

It may he found in type in Vol. IX., 2d Series, p. 387, Repertory of Arts; aud is referred to in Vol. XLIII., p. 72, *Mechanic's Magazine*:—

"Specifieation of the patent granted to William Deverell, of Charles Street, Blackfriars Road, in the parish of Christ Church, and county of Surrey, engineer, for certain improvements in the mode of giving motion to hammers, stampers, knives, shears, aud other things, without the application of wheel, pinion, or any rotative motion, by means of various powers now in common use. Dated 6th June, 1806. To all whom these presents shall come, &c., Now know ye, that in compliance with the said proviso, I, the said William Deverell, do make known and describe my said methods of giving motion to the aforesaid things, and how the same is to be performed as follows; that is to say, First, I raise steam in a boiler or steam-vessel, as in the common way. I have a steam cylinder, with a piston and rod in it; at the end of the rod that comes out at tbe end of the steam cylinder is a hammer, either made fast to thc rod by welding, or any other common way. The steam from the boiler or steam vessel is let in underneath the piston by means of opening a cock or valve, or cocks or valves; tiie air at the top of the piston will then be compressed by means of the superior pressure of the steam underneath the piston. After the piston has been raised to a given height, there will be an opening made in the under side of the piston to a vacuum formed as in the common way; or otherwise the steam may be let out into the common air. The compressed air at the top of the piston will then drive down the hammer with a velocity equal to what it may be compressed. There may he a vessel partly full of water, the top of which is made to communicate with the cylinder. At the upper side of the piston, there should be valves or cocks, or some other proper contrivance, to adjust the water, so as the air may be compressed as the velocity of the hammer may require. The hammer may be worked by steam, or some other spring that may answer the intended purpose, or by steam alone. The weight of the hammer may be made equal to the pressure of the steam, so as to work without springs. The weight of the hammer may be regulated as necessity requires, by taking one hammer off, and putting on another of a different size. The hammer may have a stilt to it, and the piston may be made fast, to haumers or stilt, as occasion may require; or otherwise there may be a lever or levers. Either of these may bc attached to the piston rod, so as to give motion to the hammer or hammers, as more than one can be worked in this way. There may be hammers worked from both ends of the cylinders, as the piston rod or ends may come out at each end of the cylinder; and the air may be compressed in the cylinder, or any other convenient vessel or vessels. The hammer or hammers may have their motion given to them by the piston rod, without heing connected one with the other, by striking on thc back part of the hammer stilt, or, otherwise, by lifting underueath thc stilt, at the hammer end of the same; hut this may be done in various other ways, not necessary here to describe. The stampers may bc worked in the same way as thc hammers. The method I make use of to work presses is as follows:—I have a lever, or compound levers, with one end of the lever or levers working on a fulcrum or joint, with the piston rod attached to one end of the same lever or levers; and as the steam is let in, the piston from the steam hoiler will lift or compress the lever or levers as may be required. The lever or levers may bo fixed so as to work perpendicularly, horizontally, or in any other required direction. The shape, size, or form of the press, may be varied agreeably to existing circumstances. The knives may be made fast to the piston rod, or any convenient thing connected with the piston rod; or, otherwise, the piston rod may be made fast to the lever or levers, or knife or kuives, or other levers may be used, if found nccessary, so as to work the knives; but these knives may he fixed in various other ways, so as to chip fustic, logwood, and other woods, and may also be fixed to any proper thing which it will work to, and again by the piston rod being attached to the same part thercof. The shears may he worked hy the piston rod being attached to the shears' lever; or, there may be a second lever, or more, if required, so that the piston rod may be attached to some couvenient part thereof, in order to give motion to the shears. I also apply the above mode for thc working or giving motion to bellows. In tbis case, the pistou rod may be attached, or made fast to the back part of the bellows, or separate levers may be made use of, wbich may be made fast to any part of the bellows. In the above, I have given a plain and clear description of the nature of my invention, and what I conceive will be fully sufficient to enable any intelligent workman to carry the same into complete effect.

"In witness whereof," &c.

Thus, then, Nasmyth was tho sccond inventor of the steam hammer; that he was a perfectly independent inventor, there is not the slightest reason to doubt; indeed, there is tolerably convincing evidence of his having been so, in his own letter above.

How, then, are we to apportion the mede of praise between these two; both prophets and one a benefactor of his age?

In purely *scientific discovery*, priority in publication is everything—the sole condition necessary to secure the crown, that shall be by all men pronounced his—to the discoverer. Admittedly this is so, since the days of Leibnitz and Newton, if not before—with one proviso, however, that the writing of him who first publishes, should present sufficient evidence, that he clearly saw the force, nature, relations, value, and general bearings, of whatsoever he had presented as new; evidence that what he said, was not merely some misty guess, or imperfectly evolved thought, neither clearly formed, nor its relations and importance seen, until, by the light, perbaps, of some other and subsequent discovery. In such a case, and many attempts to take advantage of such, are to be found in the history of science, it is the man who first *clearly grasps the thought, and with it its relations to* other cognate parts of the cosmos, as already knowu to mankind, who is justly reckoned the first discoverer.

The case is analogous in the region of *invention, i.e., of discovery* made concrete, and *applied* to a determined end. Here, it is not the man who throws out some wild suggestions, of perhaps some feasible and indubitable advantages, but with means not proposed, or inadequate, or indistinct, that is entitled to the honours, of the inventor, or, mayhap, the benefactor of mankind, but he who describes a precise aim—advautageous when achieved—and the precise means of arriving at it, described so, that it is clear, he had himself a distinct couception of the principles upon which the method reposes.

If we apply such rules to the case here, however, we find ourselves in this difficulty, that it is impossible to deny to Deverell, his having had a perfectly clear conception of the steam hammer, and of almost every combination, modification, and application, that have up to this time, been made of it; and further, that he very clearly saw the great future value, that the tool he had mentally created would present. He did not, however, see *this*, that his invention was too far in advance of his time; that there was theu no suffieient waut for it, nor use to which it was probable it would be applied. In fact, he did not realise fully the relation hetween his own meutal creation, and the state of tbe world without; hence, mainly, (though very probably also, iu part, from circumstances accidental and personal) his invention, important as it was, slept unnoticed in the dust of the Rolls' Office, and was forgotten.

Nasmyth, on the contrary, as the circumstances narrated by himself prove, re-invented the steam hammer, *when and because there was already a want of it.* His mental creation was called into existence *en rapport* with the march of the world without; he himself saw that it was so; but it is curious to remark how little others could discern of this—not even his own partners, until it was thundered into their ears by the blows at Creusot of the first hammer itself; and how nearly this incapacity of seeing, on their part, had cost Nasmyth the forfeiture of all special reward for his own creation. The hammer made by his own plans was pirated into France, and actually at work there, before he was able to patent it in England.

We may not refuse to honour the memory of Deverell, as the first inventor of the steam hammer, but we are entitled to give still higher honour to Nasmyth, who independently re-invented it; and doing so at the right time, first produced the hammer, in solid and satisfactory reali'y, and at the same time showed, what the hammer itself could produce.

Fame alone—in this case, a more than usually barren honour—remains to Deverell, and that, justice forbids us to deny or conceal from him. Nasmyth has reaped both fame, and the solid fruits iu fortune, of his own second creation, and why not?

Yet perhaps some one will say, what a monstrous example of the evil of our patent laws, or of their working; that Nasmytb should have been permitted to reap the profit of his patent, invalid as it was from the commencement, by reason of the prior puhlication by Deverell; but, softly, there *was* Deverell's specification, duly enrolled, published, printed, why did not those who would so complain, those who then paid, for Nasmyth's bammers handsomely, and who yet might have made them and sold them, if they pleased; why did uot they "make themselves up on the facts"—if they chose to be ignorant, they must take the consequences? Here, then, was uo fault to be found with the pateut law, but with themselves. In this case, through sheer good luck we think, this lapse has let for once, real justice to be done. We think Nasmyth deserved to have the reward that he has got, and not Deverell, who never appears to have made a steam hammer, and who would have found no use for it in 1806 had he made it. But Nasmyth's patent was, during its whole term, at the mercy of any oue who had chosen to rely upon Deverell's prior publication; and here is a real defect in our patent laws, though one for which it is extremely hard to devise a remedy.

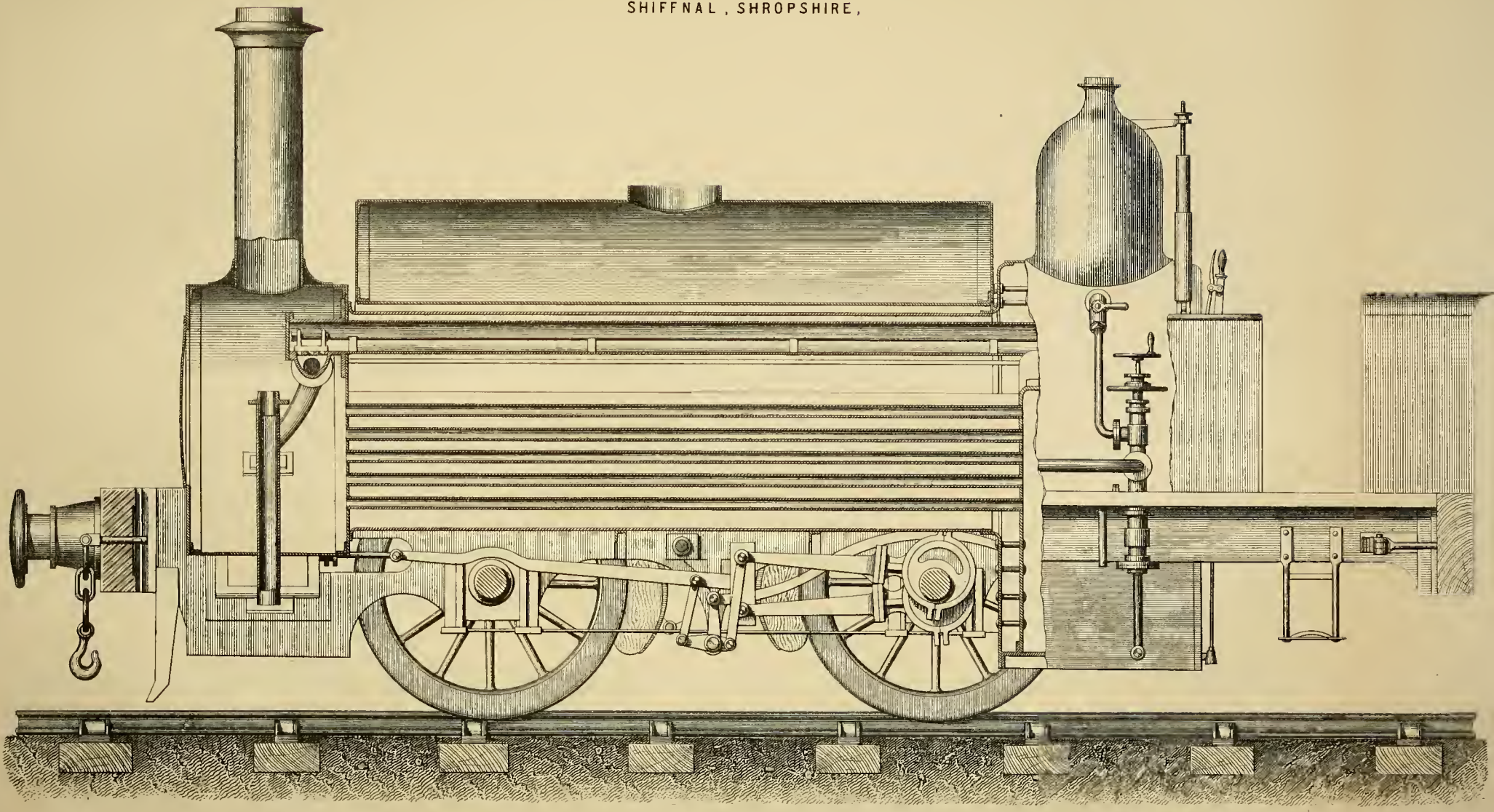
A partial removal of the evil, of inventious, "born out of due time," would be our adoption, of that part of certain foreign patent laws, whicb says, that any patentee, who suffers his patent to remain dormant for a certain length of time, forfeits his rights. But publication remains, and

Plate 292.

LOCOMOTIVE MINERAL TANK ENGINE,

BY THE LILLESHALL COMPANY,

SHIFFNAL, SHROPSHIRE,



SCALE.

INS. 12 9 6 3 0 1 2 3 4 5 6 7 8 9 10 FEET.

W Johnson, Patent Office,
47, Lincoln's Inn Fields & Glasgow

Mackay & Kirkwood Glasgow

can be still pleaded to invalidate any subsequent patent for the same object. Now, we confess to thinking, it would have been a great hardship, if Nasmyth had been deprived of reward, through the intervention of the publication, contained in Deverell's barren and unproductive specification; yet he would have had nothing legally to complain of; nor have we anything here to complain of in our patent laws, unless that it is perhaps to be regretted, that no means exist, by which a possibly inequitable result of their action, (if put in force), might be, in such cases as this, prevented.—Ed.

LOCOMOTIVE MINERAL TANK ENGINE.

By the Lilleshall Company, Shiffnal, Shropshire.

Illustrated by Plate 292.

This engine is, in its design, adapted for the mineral traffic of iron works and collieries, or for contractors' purposes, where sharp curves and inequality of temporary roads are unavoidable. Fig. 1 is a longitudinal elevation, and fig. 2 a corresponding and sectional elevation through the centre of the engine. The whole engine is very strongly and firmly constructed, to enable it to resist the violent strains and shocks produced by the shunting of heavy loads upon uneven roads, and the heavy wear and tear to which engines of this class are especially liable. The cylindrical part of the boiler is 10 feet long, and 3 feet in diameter, of 7 16ths in. plates, rivcted together with $\frac{3}{4}$-in. rivets. The boiler is placed low in the framing to avoid top weight; the outside fire box is of $\frac{1}{2}$-in. plate, 2.6 long, and 4 feet wide; it is semi-cylindrical and eccentric with the boiler. The boiler and fire-box are covered with wood lining and a sheet iron case, bound with wrought iron hoops. The inside fire-box is of copper; top, sides, and front plate, $\frac{1}{4}$ in. thick, and tube plate $\frac{3}{4}$-in. thick; the top of fire-box being supported by six strong roof stays of flat iron, with bolts passing through the stays and top of box; the external and internal boxes are secured together by means of copper studs, $\frac{3}{8}$-in. diameter, screwed through, and riveted outside. The brass tubes, $1\frac{3}{8}$ in. external diameter, 11 wire gauge, next the fire-box, and 14 wire gauge at the smoke-box end. The tank is semi-circular, fitted on the back of the boiler, and supported on four strong wrought iron brackets. The coal-box is arranged behind the driver. The engine has outside cylinders, 13 in. diameter, and 20 in. stroke; the pistons have two brass rings in each, self-acting by the pressure of the steam upon the valves; the valves work direct; the spindles work through both ends of each steam chest. The regulator is in the smoke box, and can be examined without taking any other part of the machine asunder; the copper steam pipe passes through the whole length of the boiler, and being thoroughly secured into the tube plate at the smoke-box, and into the front plate of the outer fire-box, forms a good stay. The blast pipe is reduced in length, and a loose gland fitted in to allow of varying the size of the muzzle to suit the quality of coals. The link motion is of steel hardened, and the arrangement dispenses with the necessity of balance weights, and admits of being kept low in the framing; the eccentrics are of cast iron; the hoops of brass. There are four strong wrought iron coupled wheels; the connecting and coupling rods have brasses at each end; the engine is also fitted with a Giffard's injector, and all the usual fittings for showing level of water.

STEAM FIRE ENGINES.

In connection with the article on American Steam Fire Engines in our last part, we may draw attention to the following communication made since to the *Times* by the Secretary of Bray's Traction Engine Company.

In your leading article of this day you clearly apprehend and indicate the means necessary for the better protection of life and property from destruction by fire, by the employment of steam power in place of manual labour in working fire engines.

This company has ever kept in view not only the attainment of this object, but also the equally important consideration of making steam fire engines self-propelling; and but for the obstacles thrown in the way of the more general introduction of steam on the common roads, and a consequent want of confidence and the adequate pecuniary support on the part of the public, I venture to say many small useful engines capable of propelling themselves and drawing a tender containing 1500 or 2000 gallons of water, at a speed of about eight miles an hour, would now have been in use. Steam could always be kept up in such engines by means of gas, so that they might be prepared to start immediately on the alarm of fire being given; and as they could commence throwing a mass of water on or into any building on fire equal in volume to the amount capable of being discharged by half-a-dozen ordinary hand-worked engines, without being detained while the suction hose was being fitted to the stand post or plug, a fire would often be checked at the most critical moment before it had gained the mastery. The engine built by the company to the order of Her Majesty's Government for Woolwich, now exhibiting in the International Exhibition, where it has been awarded two prize medals, has been specially fitted to be available for working as a steam fire engine in the dockyard. It has a double-acting pump, 5 in. diameter of bore, 10 in. stroke, with which it could discharge 300 gallons per minute as high as any ordinary building.

The only objection that has been raised against the common use of steam engines on the roads is the belief that they necessarily frighten horses, and this has been the more readily accepted in consequence of an order issued by the Home Secretary a few months ago with respect to the streets of London. I have the authority of Mr D. K. Clark, the company's engineer, who is well known as superintendent of the Machinery Annexe in the International Exhibition, for stating that there is not any mechanical difficulty to prevent the construction of engines which, so far as regards noise or appearance, shall be as unobjectionable in working as an ordinary omnibus.

The Committee of the House of Commons which sat in 1831 on the question of steam on the common roads stated distinctly among its conclusions—

1. That carriages can be propelled by steam on common roads at an average rate of 10 miles per hour.

5. That they are not (or need not be if properly constructed) nuisances to the public.

If, therefore, such conclusions were arrived at in 1831, surely, with the improvements that have taken place in mechanics and machinery of all kinds in the last 30 years, in must be a simple and easy matter to convince the public that there is no danger whatever in the use of steam now.

It must be borne in mind, however, that the engines hitherto built by this company were constructed for the removal of enormous weights in large masses, which necessitated their being of the largest weight and dimensions. The experience, however, which has been acquired will, it is anticipated, enable us to construct even these engines on such a model as shall render them also free from objection.

I shall be happy to afford the fullest information in connexion with the foregoing remarks to any one who may feel disposed to go into the subject.

We should be glad to see our "locomotive" makers entering the field in this new branch of engine making.

We warn them, however, that unless they apply a deal more brain and knowledge to the subject than is commonly done at once to new things by British mechanics, they will have no chance against American steam fire engine makers, who have already employed the best scientific assistance that can be commanded in the United States to perfect their engines.

The following full notice of these engines was given in England as long ago as 1853-54, and yet now, in 1862, they are but creeping into notice and use.

Cincinnati Steam Fire Engine.—This engine, which cost rather more than 2,000*l*., and weighs between five and six tons, throws 84,000 gallons in an hour. Five horses are required, four to draw the engine, and one the fuel and reel cart. Mr Dilke and Professor Wilson went to see the engine. Mr Dilke says:—"On reaching the station we satisfied ourselves that there was no fire in the engine, and that the water in the boiler was cold. On the order being given to proceed to a particular point, the light was applied to the grate, always kept ready filled with very combustible materials, the horses were harnessed, and the engine left the house in $3\frac{1}{2}$ minutes after the supposed fire was announced. It reached the spot indicated, 1,450 feet distant from the engine house, in $2\frac{3}{4}$ minutes, and in $6\frac{1}{2}$ minutes from the first announcement the horses were uncoupled and the engine placed over the supply cistern. In $8\frac{1}{2}$ minutes the steam-gauge was at 35°, and the pumps self-feeding. In 9 minutes a hose was affixed, and the reel dispatched in $9\frac{1}{2}$ minutes to about 100 feet distant from the engine, during which time a second hose was being fixed and laid out. In 12 minutes water was issuing from one hose, and in $12\frac{1}{2}$ minutes from both. In 13 minutes the jet of water reached 100 feet from the nozzle first applied, one of an inch-diameter, and from that time a large body of water was pouring forth. In 17 minutes the supply was strong enough to rise about 60 feet in height. In 28 minutes it was playing over a moderate-sized house. In 33 minutes all six nozzles were in use. In 38 minutes the issue of water was stopped, that the capability of supplying steam jets might be shown. In $39\frac{1}{2}$ minutes a very powerful blast of steam was issuing. We were informed that the engine had on two or three occasions played six hours continuously, and once 12 hours, and we were given to understand that it had thrown water 230 feet—a statement we could believe from the power exhibited, and which was shown by directing the stream against a heavy cart standing empty in the street, and which was driven by it nearly 100 feet."—*Mr now Sir Charles Dilke's Report* (New York Industrial Exhibition,) *Times*, July 29th, 1854.

EXPERIMENTAL TRIALS OF MARINE SCREWS.

THE *Shannon* screw frigate, Captain Oliver J. Jones, completed last month her series of trials between the Admiralty and Mangin screws. The whole of the trials, seven in number, have been carried out under the supervision of Captain H. Broadhead, commanding the steam reserve at Portsmouth, Mr Murdoch, Inspector of Machinery Afloat, and Mr Miller, Assistant-Engineer of Her Majesty's Dockyard at Portsmouth, having superintended the working of the machinery. In all the details connected with the trials care has been taken that each should take place under as nearly similar circumstances as possible to the other; consequently the powers of the propellers have been tested as fairly and as evenly as possible, in the sheltered position of the trial ground in Stokes Bay. The Mangin (French) screw has been looked upon with much favour of late, owing to the small aperture it requires for the well in the ship's stern as a "lifting" screw, and also from the very favourable reports which have been received in this country respecting it powers of propulsion in the ships to which it has been fitted in the French Imperial navy. At the same time it has not been without the usual quota of detractors, who have declared that the French ships fitted with it in the Baltic expedition showed no indications of possessing speed, and that a broken-bladed Mangin was no rarity in the French marine, this latter fault being ascribed to the peculiar position of the blades. As regards speed, a reference to the table below will show that the speed of the *Shannon* as given by the "Mangin" was above the average of ordinary screws; but this trial, on the other hand, was accompanied by so great an amount of vibration as must preclude the adoption of this screw for service in the English navy, with its existing arrangement of blades. These, four in number, are set in parallel pairs in close proximity to each other, and the peculiar feature in their working, which tells so much against the screw, is, that they lock the water between them and carry it round in a disc form in their revolutions, causing the vibration, and also the terrific thrashing of the water to which allusion was made in our former report of its trial. In three of the subsequent trials, blades were cast on the Mangin pattern, but, instead of being fixed on the boss in parallel pairs, as with the Mangin, they were set single at equidistant intervals on a Griffiths boss, and were tested as screws of three, four, and six blades. The four-bladed trial took place on the 4th of May, and the result gave an increase of speed, with a less indicated horse-power, over the Mangin, and an almost total absence of vibration. In the next trial of these blades, six were fixed to the same boss, but, although the result was equally favourable as regarded vibration, there was a loss with respect to speed of about a quarter knot. The trial of three blades, which had been looked forward to with great interest, as the closing trial of the series, is fully detailed in its place. It is necessary perhaps to state that these blades, cast in the foundry of Portsmouth yard, differed slightly in form from the original Mangin blades, being twice the width of the latter, owing to their being set singly instead of in parallel pairs, and taperiug slightly in their width from root and edge to their centre. They still, however, retain all the peculiar features of the Mangin proper, and can be called by no other name. The Admiralty or common screw is too familiar to call for any remarks here. On its first trial it was tested with its leading corners cut, and on its second and third with both corners cut. Its first trial, of course, gave the best results, both as regards speed and vibration, but it was inferior to the Mangin in point of speed, and to the four Mangin blades on the Griffiths boss both as regards speed and vibration. This trimming of the corners of the common screw is, however, merely an approach to the Griffiths form, and when the area of the reduced screw requires the portions removed from the edge of the blades to be added to their root, then the Griffiths patent compels the abandonment of the process. Three of the trials have been with blades cast on the Mangin pattern and fixed at equidistant intervals in a Griffiths boss, the first of the three being with four blades, which was attended with excellent results both as to speed and vibration. The second was made with six blades, but the result, although equally favourable with the four-bladed trial as regarded vibration, gave a loss of speed. The last trial was with three blades, and the speed made by the ship contrasts very favourably with the other trials, but the ship exhibited a very large amount of lateral vibration, which was the more extraordinary, as with the four blades she exhibited very little movement of any kind. The day was miserably wet; but there was little wind, with smooth water, so that the screw was tested under equally favourable circumstances with the others. The ship was about two inches deeper in the water than on any former trial. The column of water raised in the well by the working of the screw was considerably less than with the Mangin or with the four or six blades. Six runs were made at the measured mile, with the following results:—1. Time, 4 min. 40 sec.; speed in knots, 12.857; revolutions of engines, 54. 2. Time, 5 min. 49 sec.; speed in knots, 10.315; revolutions of engines, 56. 3. Time, 4 min. 38 sec.; speed in knots, 12.950; revolutions of engines, 56. 4. Time, 6 min. 1 sec.; speed in knots, 9.972; revolutions of engines, 56½. 5. Time, 4 min. 42 sec.; speed in knots, 12.766; revolutions of engines, 56. 6. Time, 5 min. 56 sec.; speed in knots, 10.112; revolutions of engines, 55½. Mean speed of the whole, 11.585 knots. The first circle was made to starboard in 7 min. 7 sec., with the rudder over to an angle of 15½ deg. The second was made to port in 7 min. 31 sec., with the rudder to an angle of 14½ deg., the revolutions of the engines being 56 and 54½.

The following tables will show the comparative results of each trial:—

No. and date of Trial.	Description of Screw.	Screw. Diamr.	Pitch	Length.	Immer.
		Ft. in.	Ft. in.	Ft. in.	Ft. in.
1. May 16	Common, with leading corners cut	18 1	25 3	3 6	1 0½
2. May 17	The "Mangin," having four blades set in parallel pairs ...	18 0	25 0	3 0	1 1
3. May 19	Common, with both corners cut	18 0	24 11	3 0	1 0½
4. May 31	Four Mangin blades on a Griffiths boss ...	18 1¾	23 7½	2 3⅝	1 0
5. June 10	Common, with both corners cut, being a repetition of a former trial	18 0	24 11	3 0	1 0½
6. June 16	Six Mangin blades on a Griffiths boss ...	18 1¾	23 7½	2 3⅝	1 0
7. July 3	Three Mangin blades on a Griffiths boss ...	—	—	—	—

No. and date of Trial.	Description of Screw.	Revol'tions of Engines.	Steam Pressure.	Vacuum.	Speed of Ship in Knots.	Indicated Horse Power.
1. May 16	Common, with leading corners cut	59·40	20	24	11·288	2054·8
2. May 17	The "Mangin," having four blades set in parallel pairs ...	53	20	25	11·328	2032·72
3. May 19	Common, with both corners cut	57·40	19·5	25	11·080	2093·92
4. May 31	Four Mangin blades on a Griffiths boss ...	53	20	25	11·550	2020·86
5. June 10	Common, with both corners cut, being a repetition of a former trial	57·70	19·5	24	11 009	2081·68
6. June 16	Six Mangin blades on a Griffiths boss ...	49·60	20	25	11·244	1946·73
7. July 3	Three Mangin blades on a Griffiths boss ...	56	20	24	11·485	—

The circles have been completed as follows:—

No. of Trial.	Time occupied in completing circle. Min.	Sec.	Angle of rudder in degrees.	Helm to
1	7	43	12½	Port
	7	24	14	Starboard
2	7	14	13¾	Port
	7	1	15¼	Starboard
3	7	43	13	Port
	7	33	15¾	Starboard
4	7	12	13	Port
	7	50	13	Starboard
5	7	50	Not taken.	Port
	7	20		Starboard
6	7	8	14	Port
	7	57	13	Starboard
7	—		15½	Port
			14½	Starboard

The *Shannon's* trials with the common screw in 1856 gave the following results in the speed of the ship and indicated horse-power of the engines:—

Date of Trial.	Speed of Ship in Knots.	Indicated Horse-Power.
November 11th, ...	10·492	1956·7
do. 18th, ...	11·216	1930·9
December 2d, ...	11·708	2114·0
do. 3d, ...	11·499	2124·0
do. 16th, ...	11·688	2216·3

In point of speed, therefore, those trials stood in the following order:—December 2, December 16, December 3, November 18, and November 11. In point of economy, reckoning the horse-power per knot, as given by the indicated power, they, however, stand as follows:—Nov. 18, Dec. 2, Dec. 3, Nov. 11, and Dec. 16. With the exception of the trials carried ont under the personal superintendence of Mr Lloyd, the present Engineer in Chief to the Admiralty, with the *Archimedes* iu 1840, and subsequently with the *Rattler* in 1843-4 5, there has, however, heen no series of trials equal in importance to those concluded by the *Shannon*, and the value of which will be still further enhanced by the supplementary trials by the same vessel ordered by the Admiralty with the Griffiths screw, with two, three, and four blades respectively. Still, it must be admitted, that all these fair-weather and smooth-water trials of screw propellers appear to give but a very inadequate estimate of the value of the screw as a propeller for sea-going ships, the only result attainable by them being a comparison of speed in smooth water, and a certain means of ascertaining an exact knowledge of the vibratory motion. As regards speed there does not appear to be a great difference between the best and worst known form of propellers, iu the majority of cases not more than half a knot an hour, and this slight difference is often due to the conditions of water and wind rather than to any real superiority of one propeller over the other. The most valuable description of screw trials are such as were carried out hy the *Warrior* and *Defence*, both of which vessels went out to sea iu search of storms and heavy weather, and in the case of the *Warrior*, accompanied hy a tried vessel—the *Revenge*, flagsbip of the Commander-in-Chief of the Channel fleet, and one of the finest and fastest of our improved screw wooden liners. Both the *Warrior* and *Defence* carry an improved Griffiths screw, the peculiarity of which consists in the points of the blades inclining forwards of the ship. The *Revenge* is fitted with the common or Admiralty screw, with the leading corners cut. In the trials hetween the *Warrior* and *Revenge* at sea under sail alonc, the *Revenge* beat the *Warrior* from two to three knots per hour, but under both steam and sail, and in a heavy sea, the *Warrior* could beat the *Revenge* from four to five knots per hour. When the *Defence* afterwards tried the *Revenge*, the latter beat the former in smooth water about as much as is due to her (*Revenge's*) extra power and reduced tonnage—the *Revenge* having 800-horse power to 3,322 tons, while the *Defence* has 600-horse power to 3,688 tons; but when both ships were tried head to wind, in a heavy sea, the *Defence* held her own, and the *Revenge* could not gain a yard upon her. It is stated that in tbe trials of both *Warrior* and *Defence* no back-lash could he ohserved in the screw shaft, nor was the speed of the engines unduly increased as is the case with the common screw, results which Mr Griffiths attribntes to tbe action of his improved screw blades. The manner in which botb the *Warrior* and *Defence* were tested under steam at sea is clearly the hest way of ascertaining the true qualities of a propeller, and the Admiralty will he doing the public, as well as themselves, great service in thoroughly testing the merits of the different propellers in every position required for seagoing ships. Yet, as we said before, the *Shannon's* trials, taking them at their true value as smooth water comparative trials, rank next in importance to those referred to as having heen carried ont by Mr Lloyd, who may justly lay claim to the credit of having most materially aided in the introduction of the screw into the British Navy. The further prosecution of the trials with a Griffiths screw of two, three, and four blades, has heen postponed for the present, in consequence of tbe sailing of the *Shannon* for tbe Mediterranean. As her cruise is, however, intended to be only a short one, it is most probable that she will yet complete her experimental trials as was originally arranged.

The area and weight of each screw was as follows:—

No. of trial	Area in feet				Weight. Tons.	cwt	qrs.	lb.
1	Of 1 blade ...	40·5	...	...	8	7	3	24
	Of the 2 blades...	81·0						
2	Of 1 blade ...	19·5	...	...	7	7	3	0
	Of the 4 blades...	78·0						
3	Of 1 blade ...	34·0	...	...	7	18	1	0
	Of the 2 hlades...	68·0						
4	Of 1 blade ...	22·5	...	...	11	5	3	21
	Of the 4 blades...	90·0						
5	Of 1 blade ...	34 0	...	...	7	18	1	0
	Of the 2 hlades...	68 0						
6	Of 1 blade ...	22·5	...	...	14	15	3	12
	Of the 6 blades...	135·0						
7	Of 1 blade ...	22·5	...	...	10	14	0	27
	Of tbe 3 blades...	67 5						

SOME THOUGHTS ON VENTILATION AND HEATING.

Ventilation and warmth—both necessary to the worlds of life—are found provided for in natnre, and as in nature every provision made is *perfect*, so we may not unprofitably seek out, tbe best and most comfortable conditions under which warmth and ventilation should be supplied artificially, by considering those, under which they are naturally provided. The world is both ventilated and heated, by "the sun going forth in his course," and a careful examination of *the way in which* he both moves and heats the air, so as with exqnisite beauty to fulfil the requirements of animal and vegetable life, suggests some of the most fundamental lessons, to the really scientific engineer engaged in artificial heating and ventilation. A large portion of the warmth, is imparted by the sun to our atmosphere, hy first heating the ground and all other *solids* on our earth's surface; and were our atmosphere absolutely pure, almost the whole of its heat would be so derived, and we should feel almost as comfortable with a keen cold air and a hot ground under foot, as when over the steam pipes in the Annexé; hut a very little vapour or dust, nay the mere aroma of the flower hed, inseusihle though it be to the balance of the chemist that is weighed down by a hair, are sufficient, as the beautiful researches of Tyndall have demonstrated, to absorb and arrest a large proportion of the solar beams, and hold them as it were in mid air before they ever reach the solids either of our earth or of our own persons.

Thus in nature we, in common with the whole animal world, are warmed at once from three sources—hy heat *radiated upwards* and past us, from the earth and from all exposed solids, and hy currents of air *evecting* this heat; by an atmosphere warmed around us, but getting cooler as we ascend, and hence never sensibly *radiating* down, heat upon us; and by direct solar ahsorption, upon the surfaces of our own bodies.

In the latter *light*, with actinic powers, mysterious, hecause still bnt little understood, but exercising most potent effects upon animal as well as on vegetable life, come chiefly into play. And these same powers of solar heat, but on a greater scale, are made by "Him that weigheth the winds" to also do the work of the world's ventilation; and in all these there is beautiful and heneficent halance. If this he in the least disturbed, we are uncomfortable. If there be perfect calm, no lateral currents, and a fierce sun overhead, the overheated earth scorches our feet and deranges the eirculation of our lower limbs. If there he a still air, and a hazy but partially penetrahle atmosphere overhead, heat radiates down upon us, and the day is oppressive; and had we space we might show, how the direct dry polar currents that we call the east wind, the cold radiation of the dewy moonlight, the muggy torpor of the cloud-covered night, when earth-heat is oppressive, the chill of the vapour-loaded wind, are all cases of the heating and ventilation balance in nature, being temporarily and locally overthrown.

Nor are the ventilating movements of the atmosphere important only to man. The hreeze that waves the branches of the forest and nods the summer flower, doubtless acts with most invigorating effect, upon all vegetable life, stimulating the circulation of the plant juices, and hardening and strengthening the woody and elastic tissues, amongst other important ends; such movements heing, in fact, the *exercise* of plants, and heing to them, what the exercise of labour is to the animal. And it is just in the losing sight of this condition, and neglecting to provide for it, that in the artificial climates of our conservatories and hot-houses, the plants never attain the vigour of out-of-door life—that thus, for example, the long, lithe bough of au Acacia that in the South African forest is as tough as whalebone, in the sickly, unhroken calm of Chatsworth or Crystal Palace, breaks unable even to sustain its own weight.

From what is thus hinted at, rather than even sketched, we may learn that, in warming our own dwellings, comfort of feeling will he best consulted, by having the warmest stratum of air near the floor; and that, though of less importance in small chambers, heated air is best not admitted high above and forced to descend upon the head, nor ventilation ensured by huge "sun-light" gas hurners flaring down upon us from high ceilings overhead.

R. M.

THE MIDDLE LEVEL DRAINAGE.

An official report just drawn up respecting the recent destruction of the Middle Level outfall sluice states several facts of interest. The report ohserves that although inundations such as that which has just takeu place are of rare occurrence, yet they have been found to prove heneficial to the crops in succeeding years. The expenses incident to the disaster already paid and incurred are estimated at from £23,000 to £25,000, to meet which £20,000 has been taken up by way of temporary loan. In reference to the future drainage of the level, Mr Hawkshaw, C.E., having been requested to consider the subject, has recommended that for the next 12 or 18 months, in addition to such drainage as can be obtained through Salter's lode sluice, siphon pipes should he laid over the recently-constructed coffer-dam, and that nothing should be done as to the erection of a new sluice until the siphons have been fairly tried. The expense of 15 siphons, with air-pumps, steam-engine, and necessary apparatus, is estimated at from £13,000 to £14,000. Six siphons only have at present been ordered hy the engineer, and are expected to be shortly fixed. The necessary legal powers to enahle the commissioners to provide for the temporary drainage and for the site of

a new sluice or other works, have been obtained by clauses in the Middle Level Drainage Act, passed in the session which has just closed. On the suggestion and recommendation of Mr Hawkshaw, Mr A. G. Linn has been appointed resident engineer of the works for one year at a salary of £1000, as Mr Hawkshaw has heavy and important works under his charge, both at home and abroad, and will probably not be in England during the autumn. Mr T. E. Harrison of the North-Eastern Railway has also been associated with Mr Hawkshaw as consulting engineer to the commissioners. It may be added that the 15 siphons proposed to be erected will have a diameter of 3ft. 6in. each, which will give the water the same scope as it had in the three openings of the ruined sluice. The whole expenses of the late casualty—past, present and prospective—cannot yet be definitively estimated; but the commissioners have determined on exercising their loan powers to the further extent of £40,000. They have already bonds outstanding to the amount of £410,000, but as the area of land to which their jurisdiction refers is 130,000 acres, this is, after all, a matter of no very urgent importance. It may not be generally known that the 6000 acres of land flooded are not comprised in the Middle Level at all, and hence the claims for compensation which have not yet been adjusted.

During the progress of the works for the remedy of this great disaster, and while the minds of those on the spot were filled with anxiety as to what each day might bring forth, much unwise and needless obloquy was heaped upon the engineers charged with the onerous duty. The final and complete success of the measures adopted, have formed the best vindication of Mr Hawkshaw's professional reputation in the matter. These measures essentially, we believe, consisted in driving a continuous *cill* of sheet piling right across the bed of the breach. At intervals heavy guide piles stood up above water, rabbated at their opposite and opposing sides; between these framed wood panels were then dropped down upon the cill; the last and closing panels being dropped at a proper state of tide, &c. And finally, large quantities of heavy gravel and clay were banked in at both sides of the panel dam thus formed, in the slack water secured by it. It is over this dam, thus consisting of a continuous diaphragm of timber in the heart of an earth work, that the siphon pipes referred to above, are being thrown, so as to deliver the water, without the risk of perforating the dam for any sluices Suitable precaution will no doubt be taken, to prevent washing away of the silty bottom by the discharge from these sipbons.—Ed.

THE PYRENEAN RAILWAY.

The successful completion of a Spanish railway across the Pyrenees, and the first which has actually passed over either of the two greatest of the mountainous ranges of Western Europe, may perhaps be deemed of sufficient interest in several respects to deserve a passing notice.

Various circumstances, also, in connexion with the undertaking, of which the first and most difficult portion has been thus happily accomplished, are remarkable enough; and they are indicative of the rapid though silent progress which Spain is making.

On the 21st of August, 1862, the first railway train, drawn by locomotive engines, crossed the chain of the Cantabrian Pyrenees, over the northern division of the Tudela and Bilbao Railway, from the seaport of Bilbao to the town of Miranda on the Ebro. On the 22d the Miuister of Puhlic Works for Spain made his inspection from Miranda to Bilbao, returning on the 23d, the passage across the mountains being made by trains running also in both directions each day. The distance from Bilbao to Miranda is about 66 English miles, of which more than 40 miles are in asceuding from the coast to the summit, which is 2,163 feet above the sea, being the lowest pass in the whole range of the Pyrenees. The northern slopes are almost iuvariably steep. Here the difficulties to be overcome are concentrated. In the present case they have been surmounted by wiuding along the shoulders of the mouutains, with heavy works of excavation, tunneling, and embankments, until the railway resembles a turnpike road more than such a line as is usually considered should he made to enable a locomotive engine to travel over it with speed and safety, and dragging heavy loads. The average rate of ascent from the sea is 54 feet per mile; the *maximum* is 76 feet. The predominant curvature has a radius of 300 yards only, and the curves are coustantly reversing. There are two points on the line at the entrance of the Concha, or Basin of Ordima (the ancient capital of the Province of Biscay), distant only 600 yards apart, measured horizontally across the neck or gorge of the basin, which are distant fully eight and a-half miles from each other in travelling along the line, and which differ 456 feet in level. A technical description of the railway would be out of place here, and it would occupy pages to paint in words the grandeur of the mountain scenery, seen as it was seen, in full perfection, under the beautiful sunny sky which heamed over each day's passage of the trains. The changes of view were almost as rapid as the motion of the locomotive engine, owing to the tortuous character of the course, forced upon the engineer hy the rugged country traversed. The last glimpse of the northern landscape which the passengers had was over the Gujuli waterfall, and down to a depth of 400 feet to the bottom of the ravine into which it fell; after which the carriages rushed into the summit tunnel to emerge into a wide meadow with a gently falling stream; for the descent on the southern side is very gradual, the average rate from the summit to the Ebro being less than 24 feet to a mile. The valley being wide, the curves are also much easier. The most remarkable point in the descent is the pass or gorge of the Techas, through which flows the river Bazas at the village of Subijana-Morillos, where Wellington had his head-quarters a night before the battle of Vittoria, in the summer of 1813.

The time occupied by trains between Bilbao and Miranda is two hours and three quarters. To the powerful locomotives of this railway, the sharp reversing curves and steep gradients in ascending from the north to the summit appear to make no difference with trains of seven or eight carriages.

In the deep Bay of Bilbao, it is proposed to construct a breakwater more than a mile in length, within which nearly 1,000 acres of sheltered anchorage will be attainable—in fact, a safety harbour, so much required at the extremity of the Bay of Biscay.

The southern division of the Tudela and Bilbao Railway, (which is to be completed by the early part of the year 1863) proceeds eastward from Miranda for nearly 90 miles, always on the right or soutb bank of the Ebro, for strategic though not for engineering reasons.

The amount expended and to be expended on the 155 miles of the Tudela and Bilbao Railway is about £2,500,000 sterling. The 66 miles from Bilbao to Miranda (including 20 miles of the most difficult of railway works) have cost merely for construction more than £1,000,000; the 89 miles along the Ebro have been made for four-fifths of that sum. The rest of the money has been spent on stations, rolling-stock, management, &c. The total, with all paid and capital account closed is £16,000 per English mile, and is within the capital of the company. The whole of this capital is Spanish money, mostly subscribed hy Bilbao and its commercial connexions. Not a share is held out of Spain or the colonies of Spain.

This line joins the Northern Railway of Spain at Miranda on the Ebro, which is opened from Madrid to the southern slope of the Pyrenees, near Alzazua, about 25 miles N.E. of Vittoria, with the exception of a gap of 30 or 40 miles. When the above gap is closed, as it will be next year, the journey from Bilbao to Madrid will be performed in 14 hours.

In the Engineering Court at the International Exhibition there is to be seen a very fine model on a large scale of the Passage of the Tudela and Bilbao Railway across the Pyrenees. The engineer-in-chief of the railway, as well as of the proposed breakwater, is Mr Vignoles, F.R.S. The contractor who executed the works through the Pyrenees, and from Bilbao to Miranda, is the celebrated Mr Brassey. The iron for the railway, the engines, and the vehicles were made in England, as were also nearly all the materials for the station, except the mere shell of the building.

RAILWAY ACCIDENTS AND LIABILITY.

The following sensible remarks upon this subject have been recently made in the city article of the *Times*:—

"At some of the railway meetings of the past fortnight the chairmen have taken opportunity to complain of the awards granted to sufferers from accideuts, and it is worthy of remark that on this question, as on most others, whenever the interests of the public are primarily concerned, the more narrow the view propounded by the Board the more unanimous is the approval of the shareholders. These points, therefore, must not be allowed to pass without exposure. Any alteration of the system which gives full compensation for every case of injury, so far as it can be measured by pecuniary calculations, would be similar in its effects to establishing a premium for mismanagement, while it would also be attended with incalculable inconvenience to every railway traveller in the kingdom. Looking at the liability to accident, no prudent person would voluntarily be a railway passenger without the certainty that some kind of provision existed to meet any expenses or loss he might sustain through being deprived temporarily or permanently of the power of gaining his living, or that might fall upon his family in case of his death. Under the existing law the railway companies are the assurers, and if this were not the case every individual traveller who might require to be protected—that is to say, every sane person in the kingdom —would have to take an assurance ticket from some company established for the purpose—a proceeding which he must ou all occasions keep in memory, and which to ladies aud infirm or nervous persous would furnish anything but an additional incentive to this kind of locomotion. At the same time the consequence would also ensue that instead of the railway company, by whom alone control can be exercised to prevent accidents, being the parties who would suffer the loss from accidents, the infliction would fall upon a corporate body wholly

unconnected with them. Of course, the idea of chairmeu and shareholders is, that if they could throw off their liability in these cases, they might still charge the same fares, aud that the difference would therefore be entire gain. Nothing could be more delusive. The public spend a certain amount on railway travelliug, and all the most astute contrivances to extract from them a larger sum would be self-defeating. If 3d, or 6d, or 1s is to be paid on each journey for assurance, in additiou to the regular fare, the result will be precisely the same as if the company raised its fares to that extent, and the problem of charging as exorbitantly as possible, without destroying traffic altogether, has already been tested to its extreme point. The extra tax, moreover, would be increased by the facts that the assurauce compauy must make their own separate profit, and also that the liability to accidents would be greatly augmented the moment the pockets of directors and shareholders were exonerated. The real position of the ease is that the public already pay to the railway eompanies their full assurance premium. The companies are acquainted with the existing law, and with this knowledge they make their calculatious as to the fares at which they believe they can obtain the largest nett receipts. If they find they have placed their fares too low to cover the liabilities to which as the law stands they are exposed, they can try the experiment of raising them. But in this process the worse managed companies would find they might be overpowered by the competition of the safer ones, who could afford to carry eheaper, and that would be very disagreeable. Hence the companies that are most notorious for want of punctuality, &c., are those who are most clamorous for a change. If they cannot get rid of liability altogether, they would have it upon the limited principle. It is "absurd," they say, that the family of a man of large income, who pays the same fare as one of more moderate resources, should receive a larger compensation in case of his death. They would like uot to pay according to the pecuniary value of that which they have destroyed, but according to a scale which, unless there was a hecatomb of slaughter, would produce little inconvenience to them of any kind. While they complain of some eases of compensation being exceptionally heavy, they say nothing of those, like that of Dr Baly, in which they escape entirely, although sisters and others may be permanently ruined. They forget also that, as their general fares are calculated so that they may cover all requirements, every passenger virtually contributes to supply the means of full remuneratiou to all who may meet with accidents. Any jargon will pass with shareholders when it is put forth ostensibly to "protect their interests," and even people who would be shocked at any approach to irreligion are content on such occasions to applaud the practieal atheism involved in the theory most popular with railway chairmen, that the world is partly governed by chance, and that there is a large class of events which do not arise from any logical causes, and must, therefore, be treated as beyond coutrol, and originating only in some inscrutable freak of maliguant powers. Happily, however, the shareholding public, although very extensive, and enjoying every seat in both Houses of Parliament, are not likely, even with all their unanimity, to prove stronger in the long run than the people at large, and it may, consequently, be hoped that juries will still, in the case of railway companies, enforce with unwavering rigidity the sound principle which pervades the law of England, that they must pay for such mischief as they create. The real interests of the railway companies are as much iuvolved in its maintenance as are those of the public. Admitting even the directorial doctrine that order is not Heaven's first law, and that things are constantly happening that have no rational antecedent, and for which, consequently, no one can be held responsible, it is still certain that, however inexplicable it may seem to these gentlemen, there is observable in every branch of occupation a uniform diminution of "unpreventible" accidents whenever the parties within whose sphere they are liable to occur are made to suffer for them, either in person or in pocket.

Pertinent to this subject, and to the collision which took place at Bletchley (London and North-Western Railway) on 22d August, 1862, Mr Thomas Wrigley, of Timberhurst, Bury, who has long been an advocate for the system of signalling upon railways called by him "affirmative," has again addressed several letters to the *Times*, in which he urges the adoption of this method. The nature of which, the following extracts, from his somewhat lengthy letters, will make intelligible:—

"Now, let any unprejudiced mind look at the report of the collision at Bletchley. A train runs through the station during the shunting of some empty carriages. I have frequently passed through at forty miles an hour. Fortunately, the engineer sees the obstruction and modifies the collision; but suppose he had not seen it? I leave the picture of the probable consequences to the imagination. And what is the excuse offered? These are the words, 'It is stated that the signals were not up at the time of the collision.' Would this have been any satisfaction to the friends of those who would have been ruthlessly slaughtered had the engineer not seen the shunting carriages?

"Now, reverse the picture. Suppose the signals to have been worked 'affirmatively.' The signal would of necessity have been up; and it would have required some one to depress it. Is it possible to suppose that anyone would have deliberately depressed the signal in the face of a train of carriages shunting? If not, then I say, without hesitation, there could not have been a collision.

"Avoid, I say, all self-acting machinery, all telegraphs, or other appliances, requiring skill or presence of mind; let the semaphore be so fixed that by its own action it will always 'stand to stop.' With such a safeguard no accidents can occur within the protection of the signal without a deliberate, and therefore crimiual, act on the part of some one at the station, or the driver himself.

"There could be no plea raised that the signal was not up,—it would be always up; none that the driver did not see it, for it would be his duty to see it before he passed. It is a simple, costless, and effeotual remedy for the evil, and perfectly compatible with the present speeds."

We should much like to see this question fairly ventilated and discussed by practical railway traffic managers, if such an individual might be found who could—i.e., dare—and would discuss it in an impartial spirit. For ourselves, we see distinctly that were every signal on every railway always set to "danger" (which is the meaning of Mr Wrigley's affirmative signalling), so that no engine-driver should be at liberty to pass until he saw the signal altered, then permitting him to go on in safety;—a much greater tension of responsibility upon railway companies' servants, and an easier and more effectual bringing-home of liability, in cases of neglect, etc., must result. We are by no means so clear, however, that the system would diminish the actual amount of accidents due to causes less preventable than carelessness; nor that sources of danger might not be introduced, not now in existence.

Neither do we see how it is certainly compatible with the high speeds of trains in Great Britain, and especially in such places as sharp curves in cuttings, etc, where the signal can only be seen a few seconds before it must be passed, at existing speeds. To this last, Mr Wrigley's answer probably would be, that its effect would necessarily be, to oblige the speed to be diminished in such places.

One thing is quite clear to us, that a much more effective executive and legislative control over the working of our railways is needed, and sooner or later—perhaps when Sydney Smith's bishop shall have been killed or roasted—must come about, although the whole railway interest and the prejudices of the whole engineering profession be opposed to it. Legislative control has been made tolerably effectual over the safety of the permanent works of the way. Why should it stop short there, at one fragment, and that the simplest part of the whole railway machine, and the least likely to go into disorder? Why should interference with the whole rolling stock, and system of working, with all the complication of points, and crossings, and signals, and so forth, be left for an impotent and profitless *post factum* official inquiry, after each successive accident? The only reply that could be made, giving a reason consistent with common sense, would be that already all had been done, that science and experience could suggest, by the railway companies and their engineers and servants, to prevent accidents, and that there seemed to be no room for improvements of any sort; that, in fact, so it must be confessed, accidents were absolutely irreducible in number or in graveness. Now, is such the fact; nay, is not the very opposite the certain fact?

What man of common sense is there, in the three kingoms, that does not know that a communication between the engine-driver and the guard, and every part of the train, would alone, greatly increase safety, and avoid altogether certain classes of accidents? Who, that has inquired into the subject, does not equally know, that the doing this is not attended with any serious difficulties or inconveniences; that it *has been done* long ago in America, and has in part actually been forced by the immiuence of danger, upon one of our great lines for their night express, which carries the Irish mail, though it has been so covertly done, and kept so quiet, that few even of the passengers know of its existence; yet the making this simple expedient of safety, universal, has been resisted with all the inertia of every company in the country, and for no better reason than that, changes cost money, and new expedients involve trouble, and extra servants, and so forth; and thus it is with a dozen other obvious matters, that every railway engineer and manager knows in his conscience, would improve the safety of railway travel, but dare not propose, much less advocate, and none of which are even attempted to be put into use.

Here, then, is a case in which the *argumentum ad grumenam* is powerless, because the *apparent* interest of railway companies runs in the opposite direction. Hence, it is one of those cases in which the soundest social wisdom pronounces, that liberty ought to be abridged by law, to the extent that shall compel the dealer in locomotion, to treat his customer, the passenger, according to the golden rule, "of doing as he would be done by." The rule of three, will not adjust the matter obviously, although, if fairly appealed to, even that might do so; for there are few who would not say that it would cost less, to prevent even *some* of the accidents on our lines, than to pay the damages for their results; that, on the London and North-Western, for example, £60,000

a-year (the average, it seems, of their actual payments in damages to life, limb, and property, for the last four years) would be better spent if invested in the means to reduction of future accident, than thus drained away from dividend, along with the tears and blood which it professes to pay for; but for the moral guilt unquestionably connected with which, it can never atone.

Throughout Germany, a railway accident is almost unknown. Superficial Englishmen, knowing little of the Continent, but "up the Rhine," etc., attribute this to the "slow speed that these Germans travel at;" but that alone is not the cause, nor a very valid one at all, for the average speed now on the Continent is twenty-five miles British per hour, and there are plenty of express trains at forty miles per hour. The real causes are effectual governmental control, which the companies themselves admit, is, nevertheless, not cumbersome, intrusive, or vexatious, and is most cordially submitted to by all; and the thoughtful and well-considered arrangements and apparatus by which all their lines are constructed and worked.

In Germany, much more real intellect, and thoroughly well-informed scientific thought, is bestowed *beforehand*, upon every work, public and private, than with us, where Mammon sits on the shoulders of every one, and, like the genius of evil, in Drayton's noble poem—

> "——————— that sate on the waggon beam,
> And in his hand a smarting whip he bore,"

urges on every railway work at break-neck speed, until "it begins to return," when, in the turmoil of traffic, improvements in arrangements, often originally defective for safety, will have become difficult, and are passed over, and their very need at last denied and ignored.

One safety arrangement, in use throughout Germany, might readily, and with great advantage, be introduced upon all our lines. At every station, on each line of rails, two bells (with a musical interval between them of a third) are placed—with hammers to strike on them, moved by a simple clock weight, held by an escapement always, except when purposely released. As soon as a train is to leave the station, the officer in charge, by means of a galvanic communication from his office on the platform, gives twelve strokes on each of the bells; it is the signal for the train to start, and to the passengers that it is doing so, on the last stroke. At the same moment, the larger bell at the next station in advance on the line, in galvanic communication, strikes a small fixed number of strokes. It is the signal to that station, that the train is coming. Thus, its advance is heralded along the whole line, with a saving distance and time of grace of some miles between to spare, for seeing that all is clear.

The system works well in Westphalia, even in cases of junctions and cross lines, almost as complicated as anything in England.—Ed.

In connection with our own views on Mr Wrigley's proposed system of signalling, we are enabled to give the conclusions on the subject, arrived at by Mr Culverwell, of the Dublin and Drogheda Railway Company, who has had twelve years' experience as a traffic manager. He says:—

"By the present method of signalling (with the exception of junctions, to which I shall presently allude) the red signal invariably signifies the actual presence of danger. The driver invariably, and at length instinctively, associates the idea of danger with it, and the moment he sees it that moment he uses his utmost efforts to prevent the train passing beyond it.

"By the method proposed by Mr Wrigley, and which for convenience I shall call the proposed method, the danger signal is to be shown all through the day except when trains are actually passing, at which time it is to be lowered, and the 'All right' signal exhibited in its stead. The advantage expected by this arrangement is stated to be that the driver would not be allowed to pass any signal without a specific act on the part of the signalman that at that moment of time the line was clear, and that the train might safely pass.

"The reader will note that by the proposed method the signal which at present is a danger signal ceases to be used as such. It is kept up through the day, at times when the line is clear, and when therefore there is not the least danger. It consequently loses the character of a danger signal, and becomes merely an order to stop signal.

"Let us suppose a driver going at the rate of forty miles an hour approaching a small station. It would be the duty of the signalman to lower the signal to 'All right' immediately prior to the approach of the train, and in practice the following would be the result:—The driver would frequently see the stop signal in the distance, and would find that it was lowered to 'All right' at his approach, sometimes two minutes, sometimes one minute, before his actual approach, according to the attention and alertness of the signalman. He would gradually become accustomed to regard the stop signal as on the eve of change to 'All right' as he approached it; and in practice the traffic would lose every vestige of the security it now possesses in the danger signal,—in fact, there would be no danger signal whatever. The only approach to a danger signal would be the stop signal, which would be exhibited at times when the line was perfectly clear; and it is difficult to conceive an arrangement better calculated to demoralize the drivers and the railway staff, for they would be deprived of the only signal they now have to indicate the actual presence of danger, and would be under orders to consider as a danger signal a signal which all would know was exhibited throughout the day when there was no danger. I am confident that if the proposed method were carried out there would be far less security than at present.

"At junctions the case is different. There the line is not, as a rule, clear. Independently of the signals, the rules of the company generally require a decrease of speed in the approach to a junction, so as to have the train under command at a less distance than on other parts of the line, and the efficiency of the danger signal in such junctions arises from the fact that on other parts of the line the danger signal means the positive presence of danger. Take away that impression from the mind of a driver, reduce the danger to a stop signal, and the driver would lose the assistance he now has. Moreover, it may be urged that at a junction there is at every moment danger. The continual crossing of trains and shunting of rolling stock make the constant use of the danger signal less exceptional than might at first sight be supposed."

We conclude from the last passage, that Mr Culverwell would be disposed to *adopt* the system of *affirmative* signals at all *junctions*, but *only* there.

The grave question would then arise of the advisability of two systems of signalling at work on the same line at the same time.

ARMOUR PLATING FOR SHIPS OF WAR.

No question is invested at present with greater interest than the one relating to the production of plate armour for ships of war. The Admiralty are fully alive to the vast importance of the subject. Scientific committees, assisted by the first metallurgists of the day, have been employed to conduct experiments and report upon them. A vast amount of information has also probably been forwarded by Captain R. S. Hewlett, C.B., regarding the experimental firing at Portsmouth; and testing "sample" plates still proceeds there as fast as they can be attached to the target ships. In testing these sample plates the knowledge gained of the structure of different kinds of iron has been very great. Some of the plates, on being struck by several 68-pounder shot, in nearly the same place, so as to compel a fracture, have exhibited a peculiar silvery appearance in the separated parts of the metal, which at the same time have shown an extraordinary length of fibre. This was particularly the case with the rolled plates made at the Parkgate Works for the experimental angulated target of Mr Josiah Jones of Liverpool. In these plates, however, as in most other rolled plates manufactured at that time, the greatest injury by the shot was found to be inflicted on the reverse side of the plate, next the timber backing, where, the layers of the metal being opened by the sudden shock of the 68-pound shot, they spread out with radiating cracks, and penetrated the timber to an average depth of from four inches to five inches. The Atlas Works rolled plates were equally faulty with the Parkgate plates, but constant manufacture and the constant practice at sample plates from both works on the sides of the target ship in Porchester Creek, which are witnessed by a representative from the firms, have supplied such an amount of valuable data to the manufacturer that they have recovered for rolled armour plates the prestige they at first had in their competition with hammered plates. It has now become a moot point which kind can be manufactured that shall to a certainty possess greater shot-resisting powers than the other. Of hammered plates the Thames Iron Shipbuilding Company are undeniably the best makers; in fact, it seems at present quite impossible, if their best sample plates tested at Portsmouth be selected, to manufacture a more perfect armour-plate. Other makers again have not been so successful, owing, no doubt, to want of experience in manufacture, but they evidently improve in each succeeding plate sent for testing. Of the condemned plates, some have broken clear through, like cakes of ice, with through rents in all directions. Others have separated into layers, so that the 4½-inch solid plate has been transformed into half-a-dozen thin sheets. In both cases, any ship covered with such armour would be more easily destroyed by shot than any common wooden ship could be. We have selected the best and worst description of plates as an illustration, but there are many other makers who have supplied plates which, although they may not stand in the first rank, decidedly do not in the last. It also happens at times that a plate of a very inferior quality is tested which has been supplied from a firm noted for the general excellence of their plates. In fact, this has happened with each of the three firms quoted above, and not in every instance can the cause of the plate's defect be satisfactorily accounted for. The vast establishments which have been formed by private individuals for the manufacture of iron plates by the roller and by the hammer, and in some instances by both combined, and the fine specimens of the manufactured and unmanufactured metal in the International Exhibition, all prove that the great iron workers of the country are equally alive with the Lords of the Treasury and the Admiralty to

the daily increasing importauce of iron in shipbuilding and in the manufacture of heavy ordnance. Perhaps if one part of the question is more open than another to a definite settlement at the preseut moment, it is the description of iron most suitable for the manufacture of the armour plate. This appears to lie between the "puddled" and "scrap." Both have their advocates. There are, however, now being manufactured in the smithery of Portsmouth Dockyard, under the large steaui hammer, two plates, expressly to settle this question for the present, as far as may be possible. Oue is being made exclusively from the dockyard scrap irou. and the other from the best Shropshire "puddled." Eaeh plate is being made 16 ft. iu leugth, 3 ft. 6 in. in breadth, and 5½ in. thick, but will be afterwards cut in two parts, oue to be annealed and the other not. When completed they will be tested iu the usual manner by the Stork's 68-pounder iu Porehester Creek, and the results cannot fail to be very iuteresting and important. Several plates were forged some time since in this same smithery, which proved, on being tested at Shoeburyness, to be of very good quality, and in the forthcoming trial a Government establishment, may possibly take the first position on the list for the manufacture of ship's armour.

The *Sultan* target ship at Portsmouth is now having six sample armonr plates bolted on her sides for testing by the *Stork* gunboat. They eonsist of four from the Mersey Steel and Iron Works, two from the Thames Iron Shipbuilding Company, one from the Monkbridge Works, and one from Messrs Hill & Smith. In February last a 4½-inch plate from the Thames Iron Shipbuilding Company was tested on the sides of the *Java* target-ship aud received six solid 68 lb. shot (the ordinary cast shot) within a space of six inches before any parts of the metal could be detached. The excellent quality of this plate attracted considerable notice at the time. Shortly afterwards, in the course of some similar experiments on the sides of the same ship, Capt. Hewlett determined to test the plate's resistiug powers still further by firing a wrought-iron shot at it from the 95-ewt. gun at the same distance at which the cast-iron shot had been fired—200 yards, hut with 23 lb. charge of powder, iustead of 16, which is the ordinary full service charge on all such occasions. The result was that the shot imbedded itself in the plate to the extent of one half its own diameter, flattening its diameter on the plate's surface at the poiut of entry from eight to nine inches, thus increasing its diameter here one inch. A bolt hole is withiu two inches of the blow; but there is not the slightest appearance of a crack in the metal, snrface or otherwise, anywhere in the vicinity of the shot, which now remains imbedded in the plate as though it were stuck into a mass of putty. Small fringes of the plate are squeezed out round the shot. This plate has now been taken off the side of the *Java*, and this week will be retnrned to the makers, on their application, by order of the Lords of the Admiralty. As a specimen of ship's plate armour and its power of resisting shot, this plate is, perhaps, unequalled, and it should be at once placed in the International Exhibition.

All this may be very well aud very true, but it does seem very much of a piece with other *mis*managements, that *one problem*, such as that of the best applied armonr plate, of the best material, should yet be simultaneously iu the hands of *three* different bodies—each experimenting wi hout concert, and actually in ignorance of each other's trials and results. Yet such is actually the case—at Woolwich the Ordnance Select Committee; at Portsmouth the Admiralty direct; and at London and Shoebnryness, the Speeial Plate Committee, controlled and thwarted by the Admiralty, are all separately at work, aud have been so for months past.

OUR IRON-CASED FLEETS.

Mr John Scott Russell's pamphlet, noticed by us in August last, has brought forth a champion for the Admiralty, in the person of Mr E. J. Reed, See., Ins. Nav. Architects; and, as most of our readers probably know, engaged, nnder Government, in applying armour, according to peculiar designs of his own, to certain timber-built ships of war. A controversy has been carried on in the pages of the *Times*. The following extracts from Mr Reed's letter of the 8th August, 1862, give a fair notion of what can be said in favonr of the Admiralty side of the question. He says—

"I will first, if you please, deal with the statement that at the present moment the Admiralty are building no iron-cased fleet It is not always easy to fix precisely the sense in which this word 'fleet' is employed, but the context shows that Mr Scott Russell means by it a number of 'similar and equal vessels capable of co-operation,' and these, he says, the Admiralty are not building. In support of this assertion, he cites a recent speech of the Duke of Somerset, in which his Grace said,—'We have at the present moment building at least ten or twelve different kinds of iron-plated ships, different sizes and different forms of vessels, in order that we may arrive at one which will be a good vessel without being a very costly one.' From this strictly accurate statement Mr Scott Russell draws the inference that his Grace is 'building no fleet at all,' and even puts that assertion into the mouth of the First Lord himself.

"Now, it can be shown to the satisfaction of auy dispassionate person that this inference is quite erroneous. The very opposite of it is, in fact, true; the first fleet which they are preparing will consist of six of the largest and most powerful iron-cased ships in the world,—viz., the *Warrior*, *Black Prince*, *Achilles*, *Northumberland*, *Minotaur*, and *Agincourt*. The whole of these ships are intended to steam at a speed of fourteen knots an hour,—a speed to which, I believe, every one of them will attain, and which is unequalled hy any other iron-eased ships in the world. The only important differences between these vessels consist in certain variations in the extent of the armour with which they are plated. The *Warrior* and *Black Prince* are plated partially; the *Northumberland*, *Minotaur*, and *Agincourt* will be completely covered, and the *Achilles* will be like the *Warrior*, hut further protected between wind and water with the helt which I have had the honour to introduce. In order to meet these changes, the dimensions of the vessels have also been correspondingly varied, for the very purpose of securing a uniform speed iu all, that the whole might act together as one colossal fleet.

"If it should be objected that in this fleet there are but six ships, I answer that six such ships are enough to form a fleet. At the most moderate estimate they will cost more than two millions sterling, aud therefore, in money value, no less than in offensive and defensive powers, will be equivalent to twenty of our old 100 guu line-of-battle ships.

"We have next in progress a second set of no less than nine iron-cased ships, all capable of co-operating together as a fleet, because they are each of about 4000 tons burden, and each steam at from 11½ to 12½ knots. Of these five are being built of timber (like most of the French vessels), and then plated with iron, while the remaining four are to be of iron throughout. The five plated timber ships are the *Prince Consort*, the *Royal Alfred*, the *Royal Oak*, the *Ocean*, and the *Caledonia*, all of which will steam from 12 to 12½ knots. When we consider that they are to be plated all over from stem to stern, and will therefore each carry a large number of protected guns, we might without exaggeration consider that of themselves they are not unworthy to be called a formidable fleet. But there is uot the shadow of a reason why we should not join with them the iron ships *Hector* and *Valiant*, which are as nearly as possible of the same tonnage, and which are expected to steam at just the same rate. The remaining two of the nine vessels are the *Defence* and the *Resistance*, each of which is of 3700 tons burden, and have actually steamed at 11½ knots. So that here we have another splendid fleet of nine—or, to say the least, of seven—well-matched vessels, all much more nearly equal than those which composed our fleet during the wars, and all undoubtedly capable of co-operating in the most reliable and perfect manner."

After some remarks, not of a very damaging character, upon Mr S. Russell's "imaginary conversations" at the Admiralty, Mr Reed proceeds:—

"But to return to the vessels. Mr Scott Russell does them great injustice when he says they are no better than 'what are technically called mere tubs.' It is true that they are very imperfectly protected; that their ports are comparatively low; and that their speed is less than 12 knots. But this is all that can be said against them. As regards their lines, they are really most excellently formed vessels; and it seems to me a great exaggeration to pronounce a ship with ports seven feet above the water, capable of steaming at what many consider a very good speed, and formed so as to behave admirably in a sea-way, a 'mere tub.' I deny altogether that a ship of this kind is what we technically understand by that expressive phrase."

This in reality is a discussion simply as to what ought to be called a tub, and what not. Much more pertinent to the subject in debate is the following and nearly concluding paragraph, in which we think Mr Reed concedes pretty nearly the whole foundation on which Scott Russell's accusations are based:—

"I do not think I need extend these remarks upon Mr Scott Russell's letter any farther, except to say that I agree with him in believing that we have wasted money in building so many unprotected wooden ships. Even on this subject, however, much might be said in mitigation of a harsh judgment. We must remember that the Board of Admiralty are compelled to rely greatly upon their professional advisers, and professional shiphuilders are only just now awakening to the fact that we can build small iron-cased vessels as well as large. I was myself told, only three months ago, by naval constructors in high positions—and very able naval constructors, too—that the thing was impossible. Fortunately, however, it is not only possible, hut practicable, and even easy." Here is Mr Reed himself saying, in fact, though in other words, exactly what Scott Russell condensed into his apothegm—Where the knowledge is the power is not, and where the power is the knowledge is not.

Mr Russell has replied, admitting that "this is the very best reply that the case admits;" and Mr Reed's rejoinder, 14th August, '62, is little more than a disavowal of his being engaged in "pleading the cause of the Admiralty." He says—"I have no intention to become the apologist of the Admiralty, nor have I the slightest claim to represent them in any way whatever. We all agree that they have gone on

building unprotected wooden ships too long, but we do not all take the trouble to remember that this remark applies to large ships only. It is only very recently that they have had an opportunity of building small iron-cased seagoing ships of war, for it is only very recently that the means of building such ships have been devised. Every one seemed to agree until lately that the thing was impossible; and I claim for myself the sole credit of showing how such vessels can be as completely protected as our large ships,—very much more efficiently protected than the *Warrior*, in fact. In working out this result I have had every facility afforded me by the Admiralty"

In conclusion, we ourselves think the case against the Admiralty still stands "proven,"—in essence, indeed, admitted, by Mr Reed himself.

The anxiety to keep to wooden ships and the dock-yard system at any price, superadded to many evils of old standing, have been the source of all these later, not-doings and misdoings.

Mr Reed has stepped in at the happy moment, to present himself as a mechanical mediator; and is yet to prove that small—and if small, why not large—ships can be built of wood, and yet durably and efficiently covered with armour plating. We wish him full success, though compelled so far to believe that he is engaged in an impossible problem.

His success, if in the true and honest sense of the word it ever take place, will be the best possible answer to those who have hitherto questioned the conduct of the Admiralty.—Ed.

THE *WARRIOR* AND THE ADMIRALTY.

The following generally pertinent remarks upon the *Warrior* and cognate subject are abridged from our lively and caustic cotemporary, the *Saturday Review*:—

The shape of the *Warrior's* hull has been the theme of praise ever since she first floated on the Thames, but there is something curiously incongruous in the look of her masts and yards. The great space which intervenes between her fore and main masts suggests at first sight the observation that she badly wants another mast besides the traditional three of the line-of-battle ship. When the authorities began to build the *Warrior* there should have been an end at once to the empire of tradition, whether in great things or small. But it was determined that a vessel entirely novel in her build should be rigged after the pattern of the vessels she was intended to supersede, and accordingly the *Warrior* was supplied with the masts and sails of a 90-gun ship. To do any good she ought to have at least four masts, and probably a fore-and-aft rig, something like the Great Eastern's, would suit her best. It is not, however, to be expected that, with this or any other arrangement of masts and sails, she will ever be eminently clever in her performances as a sailing vessel. Perhaps, if rigged differently, she would do as well as is possible under all the conditions of her construction; and certainly it is very difficult to believe that any of the newer models of iron-plated ships will in this respect be improvements on her. The public is willing, if possible, to believe in the efficiency at all points of the *Warrior*, but it must be confessed that the reports which may be heard on board the ship are not in all respects encouraging. That cruise in the Bay of Biscay has left living impressions on the minds of all who were present in it. The ship rolled awfully, and she pitched her bows under water in quite an unusual and alarming manner. The opinion appears to prevail among her crew that she is particularly unpleasant in bad weather. Probably there is not a man on board of her who is not sensible that service in her is far less comfortable than in any wooden line-of-battle ship. Of course, no reasonable being would deny that the *Warrior* would be infinitely preferable under fire, but then a battle may not happen to a sailor once in his life, whereas bad weather is certain to occur on many days of it. No doubt it is very foolish of sailors to think of what is immediate and trivial, and to forget what is distant and of grave importance. But herein sailors are not very different from the residue of mankind. So far as may be judged from inquiries on board the *Warrior*, she cannot be considered to realize the character of an armour-bearing ship which is also a thoroughly good sea boat. It would be far more agreeable to find all that has ever been asserted in her praise confirmed by the testimony of those who have served in her. Still it is better not to disguise the truth—if truth it be—that the problem of reconstructing the navy has not yet reached a satisfactory solution. For a war ship it is difficult to feel any doubt of the *Warrior's* tremendous efficacy; and, as regards seaworthiness, we do not know where the iron-plated ship is to come from that shall beat her. Nevertheless, if the effective British navy may now be taken to consist of the *Warrior* and three other iron-clad ships, the British supremacy at sea must depend a good deal on the power of imagination of those who may submit to it. Assuming that a naval nation ought to possess some ships able to go anywhere and do anything, it may reasonably be demanded when and on what principle the authorities propose to provide such ships. It should not be left unnoticed that, while the *Warrior* has been lying in Portland Harbour, the *Defence* has gone with the Channel Fleet as far as the coast of Sweden. One explanation suggested of this arrangement is, that the *Defence* has been found on trial a more manageable ship than the *Warrior*. If this be so, it would appear that the comparisons between these two vessels have been unduly disparaging to the smaller. The *Warrior* now carries a very short bowsprit. When she was in the Bay of Biscay she had the usual bowspirit of a 90-gun ship, which was thought to have contributed to excite the inconvenient movement of her head. If it be true, as one of her crew stated, that 'she could not rise to the sea at all,' it is not very agreeable to contemplate what, under similar circumstances, would be the behaviour of one of the iron-plated ships of the newer model which are to carry armour from stem to stern, instead of only amidships as the *Warrior*. It certainly is disappointing to find that this plan of relieving her bows of the heavy weight of armour has not been so efficacious as might have been expected. On the whole, it appears that, in the opinion of those who have sailed in her, the *Warrior* is very inferior in seaworthiness to a well built timber ship. Her steering is allowed to be now tolerably good; but, perhaps, capable of being improved by giving her a larger rudder. The rifle tower which has been erected on her deck is a mere oval screen of wood and iron, without any top to it; and as it communicates with the main deck, if ever an enemy should venture to board the *Warrior* he would not have to complain that he could find no access to her interior. Indeed, the *Warrior* with her roomy deck and capacious portholes, looks the very opposite of those American vessels upon which it appears that boarders cannot gain a footing. But it is only the portholes on the upper deck of the *Warrior* which can be called capacious, for those on her main deck are only half the width usual in line-of-battle ships. This has been objected to it on the ground that it would not be possible to heave the guns overboard to lighten the ship under stress of weather. Of course, it is natural to remark that there was so much iron fixed immovably to the ship that whether the guns could or could not be got rid of could not make much difference. The general result of inquiries appeared to be that Jack is a good deal of a Conservative in his view of the question between wood and iron. Of course, he would not deny the valuable defensive property of iron; but, for all other purposes except fighting, he decidedly prefers wood. An iron ship is the best to fight in, but very much the worse to live in. In an arctic climate the *Warrior* would be miserably cold—in the tropics she would be insufferably hot. It is, however, satisfactory to find that if her crew do not appear to be violently in love with the ship, they express confidence in her armament. The numerous complaints which have been urged against the heavy Armstrong guns do not seem to have disturbed the minds of those who have to work them. Such slight accidents as have occurred are attributed by the men to inattention or imperfect knowledge of drill. The ship is well gunned, and carries her guns well out of the water, but although there is at least nine feet clear as she lies in harbour it is by no means certain that she could fight her guns effectively in a rough sea. It is, perhaps, not surprising that such a ship should be troublesome in bad weather, but astonishment as well as regret will be felt at hearing that her speed, under favourable circumstances, is now asserted to fall short of what she has had credit for. When the Admiralty lately visited Portland the *Warrior* made a run of 60 miles in company with their Lordships' yacht. It is stated that the *Warrior* was rather better than the yacht, and that the utmost speed of the yacht did not exceed 11 knots per hour. It is calculated on this basis that the *Warrior's* best pace is not beyond 12 knots per hour. As this report of her latest performance prevails at Weymouth, it seems proper to take notice of it, but at the same time it is to be observed that earlier reports, which have been supposed to be reliable, ascribed to her a much higher rate of speed. A visit to the *Warrior* impresses strongly on the mind how great is the change which is taking place in naval warfare. Such a ship would be very well in the Channel for home defence, or she would be very well if stationed in a colony having a proper dockyard for her accommodation. But she is not suitable to be sent for a three years' cruise in the East Indies or Australia, under the supposition that she would be complete within herself for every exigency. Yet it will be necessary, sooner or later, to have ships something like her wherever important British interests need protection, and the ships cannot be effective without establishments which will to a great extent require to be created. It may turn out in the end to be true economy to create such establishments, but it is certain that they will not be created until long after the need of them has arisen, and whenever anything is done it will be done hastily and expensively. As the Admiralty cannot be persuaded to set about constructing adequate docks at home, it would be extravagant to expect them even to entertain the idea of the necessity of similar works abroad. And yet, as in undertaking such works the Admiralty would see their way clearly towards spending money, it is perhaps surprising that they do not show greater alacrity for the business.

The following is the state of our fleet of the future, as on 1st September, 1862. Iron-cased ships and floating batteries, building or afloat:—

IRON BUILT.—(BUILDING.)

Name.	Horse power.	Speed in knots.	
Achilles	1,250	14·1	estimated.
Agincourt	1,350	14·3	do.
Minotaur	1,350	14·3	do.
Northumberland ...	1,350	14·3	do.
Hector	800	11·75	do.
Valiant	800	11·75	do.
Prince Albert ...	500	11·4	do.
AFLOAT.			
Black Prince ...	1,250	14·3	estimated.
Warrior	1,250	14·354	by trial.
Defence	600	11·356	do.
Resistance	600	12·331	by trial without stores.
FLOATING BATTERIES.			
Erebus	200 ...	about 5·5	
Terror	200	do.	
Thunderbolt	200	do.	
WOOD BUILT.—(BUILDING).			
Caledonia	1,000	12·4	by trial without stores.
Ocean	1,000	12·4	do.
Royal Alfred	800	11·5	do.
Royal Oak	800	11·5	do.
Favourite	400	10·87	do.
Enterprise	160	9·50	do.
CONVERTING.			
Royal Sovereign ...	800	12·25	do.
AFLOAT.			
Prince Consort ...	1,000	12·4	do.
FLOATING BATTERIES.			
Ætna	200 ...	about 6·0	
Glatton	150 ...	about 5·5	
Thunder	150 ...	do.	
Trusty	150 ...	do.	

Of the iron-built vessels, the *Prince Albert* and the three floating batteries are, or are to be, wholly cased with armour plating, the rest partially; of the wood-built, the *Favourite* and *Enterprise* are to be partially cased, the rest wholly. Only the *Prince Albert* and the *Royal Sovereign* are to be fitted with Coles's cupolas; the rest with masts.

RECENT PATENTS.

HYDROSTATIC COTTON PRESS.

E. T. Bellhouse and W. J. Dorning, *Manchester.—Patent dated February* 6, 1862.

In this invention the patentees have described a novel arrangement and combination of hydrostatic cylinders and rams, or of a hydrostatic cylinder and ram, with other mechanical contrivances for compressing and packing into bales cotton, wool, yarn, fibres, hair, or other compressible materials. The description hereinafter given refers more particularly to the adaptation of this invention to the packing of cotton bales in a suitable form for shipment from India, although this is only one of its numerous adaptations.

Fig. 1 of the annexed engravings is a vertical section of one arrangement of this improved hydrostatic press, as constructed for the packing of cotton, and fig. 2 is a sectional plan of the same, corresponding to fig. 1. The essential feature of novelty in this press is the combination of vertical and horizontal pressure exerted upon the same bale in one operation. The ram-heads, A and A^1, of the vertical and horizontal presses, respectively work within their corresponding vertical and horizontal boxes or cases, B and B^1. The cotton or other material to be compressed is introduced into these boxes or cases through suitable apertures closed by hinged doors or otherwise. One of these doors on the casing, B^1, of the horizontal press is shown at C. The spaces above and in front of the ram-heads having been filled with cotton, the table or ram-head, A^1, of the horizontal press is forced by the ram laterally until it becomes level or flush with the side of the box or casing, B, of the vertical press, as shown by the dotted lines in fig. 1. The ram-head or table, A, of the vertical press, is now caused to rise, and the already partially compressed cotton is further compressed in a vertical direction until the whole is contained within the small space between the ram head or table, A, and the top of the vertical press also shown by dotted lines in fig. 1. The upper part of the box or casing, B, is then opened by hinged doors or otherwise, so that the bale may be covered with canvas and corded or hooped in the usual way, a chain and counterweight, D, or other suitable contrivance in connection with the horizontal ram, A^1, serving to draw it back so soon as the water is allowed to escape out of the horizontal cylinder

Fig. 1.

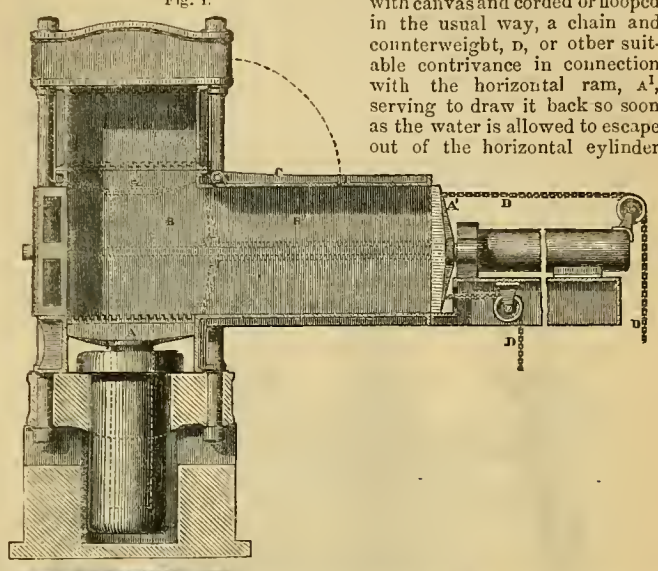
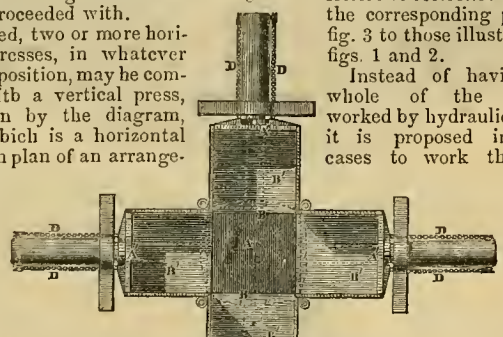


Fig. 2.

so as to lie in readiness for a fresh supply of material. The ram and table of the vertical press are allowed to descend by their own gravity after the bale is completed, and the making of another bale is proceeded with.

If desired, two or more horizontal presses, in whatever relative position, may be combined with a vertical press, as shown by the diagram, fig. 3, which is a horizontal or section plan of an arrangement wherein four horizontal presses are shown combined with a vertical press. In lieu of placing the supplementary presses in a horizontal position, they may, if preferred, be placed in oblique positions at any angle desired. The same letters of reference indicate the corresponding parts in fig. 3 to those illustrated in figs. 1 and 2.

Fig. 3.



Instead of having the whole of the presses worked by hydraulic power, it is proposed in some cases to work the horizontal or supplementary presses by suitable mechanical movements giving the desired amount of pressure, but in all cases the final vertical pressure is given by a hydrostatic press.

SEWING MACHINE.

James Willcox, *London.—Patent dated February* 19, 1862.

This invention embraces a peculiar manufacture of frills, ruffles, or trimmings, and to a peculiar combination of mechanism to be applied to a sewing machine for producing the same.

The essential peculiarity of these frills, ruffles, or trimmings, is that the folds, or plaits, are crimped in one direction, and transversely to the cloth, in a perfectly even and regular manner, and secured by stitches, in lieu of the fabric being puckered, or gathered in the ordinary manner The folds, or plaits, may be either secured by means of a single row of stitches, or by two or more parallel rows of stiches, that portion of the

frill comprised between any two rows of stitches consisting of a series of parallel and regular folds, or plaits, which may, in some cases, be used as an ornamental band to the frilling, or frill portion which is compressed between the hem or selvedge of the fabric and the outer row of stiches. These ornamental frills may be made either double or single, that is, with one or both edges left full. Another peculiarity of this improved frill is that the hem, or hems, or selvedges, on one or both edges of the fabric are crimped simultaneously with the intermediate portion. Fabrics may be crimped so as to produce the above described frills either singly, that is, with the folds or plaits secured on to the same piece of fabric from which they were formed, or two fabrics may be used, one of which forms a plain band on to which the other fabric is crimped and secured by stiches simultaneously.

The peculiar combination of machinery, or apparatus, is shown in the subjoined engravings as adapted to an ordinary sewing machine for the purpose of producing frills.

Fig. 1 is a side elevation of the entire apparatus as adapted to a Willcox and Gibbs' sewing machine. Fig 2 is a corresponding plan of the same, with the upper fixed arms or brackets removed. Fig. 3 is

Fig. 1.

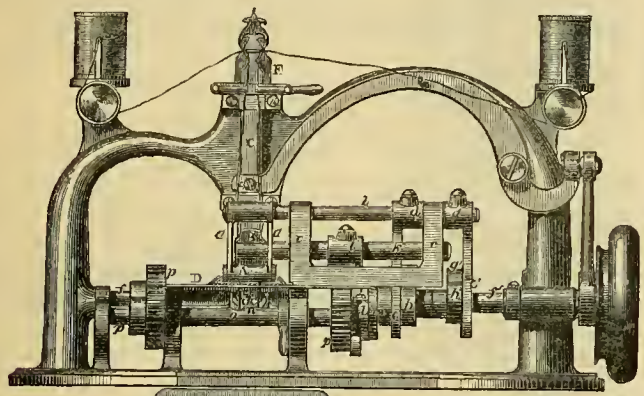
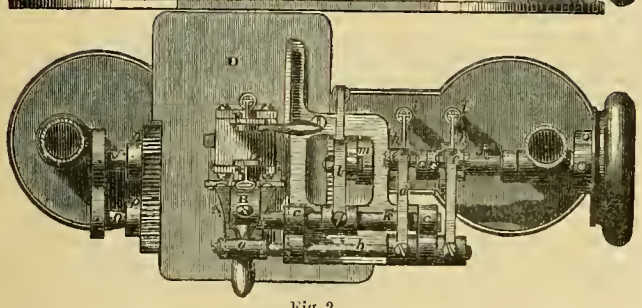


Fig. 2.



a vertical section of the crimping mechanism, and fig. 4, a corresponding plan of the same, with the presser foot removed. Figs. 5 and 6, are plans of the upper and under sides respectively of the peculiar presser foot detached. Fig. 7 represents one form of frill, or trimming as produced by this machine. The essential features of this invention are shown in figs. 1, 2, 3, and 4, where A represents a reciprocating knife which rests upon the fabric represented by a dotted line to be crimped, being pressed down thereon by a yielding spring presser finger, B, when moving forward towards the needles, C, and released from pressure when making its return, or back stroke, so as not to draw the fabric back with it. The edge of the blade may be slightly serrated, and have notches made in it corresponding to the positions of the needle, or needles, so as to allow it to advance slightly beyond the needle holes in the cloth plate, D. E are four serrated feeding bars, having the ordinary and well-known four motion action imparted to them simultaneously by a crank pin, or cam, or cams,

Fig. 3

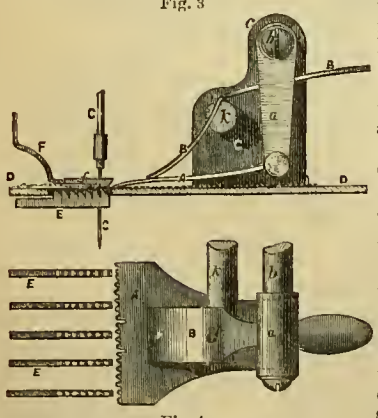
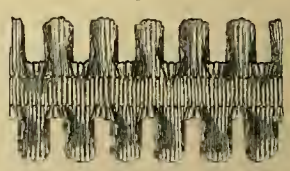


Fig. 4.

as is well understood by persons conversant with sewing machines. These feeding surfaces work through corresponding slits in the cloth plate, D, and impart the feed, or traverse, to the material after each plait or fold has been completed and fastened by the sewing instruments, the fabric being held down thereon by the peculiar yielding presser foot, F, (figs. 5 and 6.) This foot is provided with a spring blade, *f*, of a length sufficient to extend across the entire width of fabric to be operated upon—its two ends, which project beyond the side of the foot itself, are made to spring, or yield slightly in an upward direction so as to allow for the increased thickness of the hem, or selvedge, previously formed on the edges of the strip of fabric; the front edge of the presser foot and blade is bevelled on the under side, and the projecting ends of the blade are notched, or toothed, for the purpose of retaining the newly formed plait. A number of indentions, or serrations, may also be made, if desired, on the underside of the presser foot, so as to allow the plaits to travel freely under them during the feeding of the fabric, but effectually prevent the fabric from moving back in the opposite direction on the return of the knife. When in operation, the fabric, which is held down upon the cloth plate by the presser foot, F, so as to nip it between the two surfaces, is plaited by the forward motion of the reciprocating knife, A, which takes up a certain portion, or length of the fabric, according to the length of its stroke, and forms a plait as shown in figs. 1 and 3, which it pushes under the bevelled edge of the presser; this motion taking place whilst the needle, or needles, are in the cloth. So soon as they have risen clear above the fabric, however, the feed surfaces, E, which have already been elevated so as to bear against the under surface of the fabric, move forward, carrying the fabric with them, the knife, A, following in the same direction. The needle, or needles, again penetrate the fabric, and the knife then returns in readiness to form the next plait, the pressure upon it having been removed before such back stroke. When one strip of fabric is required to be sewn in a plaited or crimped form on to a plain band, or fabric, the strip forming such band, and which is not intended to be plaited or crimped, is laid upon the other strip, but passes over in place of under the reciprocating knife, and then under the presser foot in company with the lower strip, which latter is crimped or plaited by the action of the knife as before described, whilst the upper strip not being acted on remains uncrimped, or plaited, and is sewn in a plain state on to the crimped fabric. In figs. 1 and 2, the apparatus above described is shown as adapted to a Willcox and Gibbs' chain stich machine provided with two parallel needles, and two rotating hooks so as to form two parallel and distinct lines of stiches along the trimming. The reciprocating knife, A, is connected by a pair of links, *a*, fast to one end of a rocking spindle, *b*, working in the small brackets, or supports, *c*. To the other end of this spindle are keyed two slotted lever arms, *d*, d^1, to the free ends of each of which are connected the slotted links, *e*, e^1, respectively. These links are forked at their lower ends, and the forks pass on each side of the main, or cam shaft, f^1, of the machine, which thus serves as a guide for the links in their vertical movements. A stud, or antifriction bowl, *g*, g^1, is fitted into the side of each link, *e*, e^1, and these studs, or bowls, are acted upon by the cams, *h*, h^1, respectively, the one cam giving the first forward motion to the knife by raising the slotted lever, *d*, and the other coming into action a little later for the purpose of giving the second forward movement to the knife when the feed of the cloth is taking place. If preferred, one cam can be made to perform both movements. The studs, or bowls, are kept in constant contact with the surface of the cams by the action of the helical springs, *i*, i^1, connected to the outer ends of the two slotted levers respectively. The presser finger, B, which bears upon the knife, A, is carried on the end of a second rocking spindle, *k*, parallel to the first, *b*, and having a slotted cam, *l*, keyed thereon, which is upraised by a cam, *m*, on the cam shaft above referred to in a similar manner to the slotted arms, *d*, d^1, for working the reciprocating knife. The feed motion is obtained in the same manner as in the Willcox and Gibbs' machine, and the second rotatory hook is carried by a short spindle, *n*, which receives a corresponding rotatory motion to the main, or cam shaft, which carries the other hook by means of a carrier shaft, *o*, and train of equalised gearing, *p*. The supply of the threads to the two needles, and the tensions of those threads may be effected in any of the common methods, so that further reference to these and other well known requirements of the sewing machine generally is unnecessary. Fig 7 is a plan representing a small piece of the double frilled trimming, to half the real size, and crimped right across, with two parallel rows of stitching between them, as produced and sewed by the mechanism above shown and described.

Fig. 5. Fig. 6.

Fig. 7.



PAVING TILES.

J. H. Johnson, *London*, (Sylvain Follion, *Paris.*)—*Patent dated June 22, 1861.*

The specification of these Letters Patent embodies a peculiar manufacture of tiles or blocks for paving floors or covering other surfaces where hard and durable materials are required, and consists in manufacturing such tiles or paving blocks from a composition of hydraulic lime and sand suitably prepared and pressed into the desired form by mechanical pressure. In carrying out this invention the hydraulic lime is first broken up into small fragments of about the size of ordinary road-metal, and laid evenly in layers from two inches to about six inches in thickness; these fragments are then moistened with water sprinkled lightly over them from a rose jet until the lime commences to slack, when the layer is immediately covered by a layer of very fine sand, preference being given to river sand. Over this layer of sand a fresh layer of the lime is laid, which is watered, as before, and covered with fine sand, and so on with any desired number of alternate layers of hydraulic lime and sand, each layer of lime being slacked and covered with fine sand—the last or uppermost layer of sand being well batted down to keep in the heat of the mass as much as possible. The quantity of water used for slackening the lime should be about 22 gallons to each cubic yard of hydraulic lime, but this proportion may be varied accordiug to the temperature and degree of moisture of the atmosphere. The mass thus prepared, in the proportion of about one part by measure of sand to three parts of lime, should be allowed to stand for about 45 days. These proportions of lime may be varied, however, according to the quality of the lime employed—good lime requiring more sand than lime of an inferior quality. In all cases, it is important to mix the ingredients well together in order to impart strength and cohesiveness to the mass. After the expiration of about 45 days the preparation will be found to be in the state of a slightly moist powder, which should now be well stirred and thoroughly mixed by any suitable implement. This powder having been well mixed, is sifted through a No. 30 mesh sieve, the finer portion only of the powder being used. The sifted powder, whilst still in a moist state, is submitted to the action of a press, and thereby pressed into the form desired. Should the powder be found to be too dry, it may be moistened with water, and spread out in a layer or couch, which should be allowed to stand for about two days, when the powder may be pressed into shape. In manufacturing a tile or block of this material, a quantity of powder equal to about three times the volume of the tile or block to be produced is placed in a mould of the desired form, and is then compressed therein by means of any suitable press.

On being removed from the moulds, the compressed blocks or tiles are laid on hurdles or drying frames so as to expose them thoroughly to the air for about three days, when they are dipped into clean water and again deposited on the drying frames, and left for about two months, after which period they will be ready for the market.

In lieu of allowing the original mass to remain at rest for 45 days before sifting, the mixture of hydraulic lime and sand may be sifted at the expiration of about 15 days, and then made into a mass again after having been well mixed and left to stand for another 15 days, water being sprinkled over it if the powder be found too dry. Coloured blocks or tiles may be made by this process by mixing any colouring matter with the sand which will combine or mix with the hydraulic lime without impairing its properties. To obtain black tiles or blocks, lamp black may be mixed with the sifted material. In all cases, the intensity of colour may be raised by adding more or less of the colouring material. These tiles or blocks are intended to be laid in a similar manner to ordinary tiles, with common mortar, after first steeping them in water for about ten minutes immediately before laying them.

It is obvious that tiles or paving blocks of all shapes or sizes required, as well as other articles of a like nature, may be manufactured according to this invention.

HYDROSTATIC PUMPS AND PRESSES.

Alexander Samuelson, *London.*—*Patent dated January 25, 1862.*

These improvements relate to a peculiar combination and arrangement of pumping apparatus for hydrostatic presses, which enables a double press to be worked by the aid of four pumps, producing a regular and unintermittent action upon the rams of the presses operated upon, and thereby gaining a considerable saving of time and labour in such process. In carrying out this invention, two pairs of pumps are used, each pair consisting of a large and a small pump. The large pump of one pair of pumps is connected to the small pump on the opposite pair by pipes communicating with one single stop, and this stop is in direct communication with one half of the double press, the other half of the press being in a similar communication with the corresponding stop of the other large and small pumps, each single press having its own large and small pump and single stop. For convenience of arrangement, it is preferred to place all the four pumps in one line, parallel to the centre line of a vibrating lever, and in the same vertical plane therewith. Although the patentee prefers to use the lever motion here described, he does not confine himself thereto, as it is obvious that the necessary alternating motion may be given to the plungers of the pumps by means of cranks, eccentrics, or other mechanical contrivances.

Fig. 1 of the accompanying engraving is a side elevation, partly in section, of the improved arrangement of pumps and stops; and fig. 2 is a corresponding plan of the same. The cistern, A, containing the water, or other liquid to be pumped, is fitted with a cover or strong longitudinal plate, which supports the two sets of double pumps and their working parts. The large and small pump, B B^1, respectively, is placed near one end of the cistern, and C C^1, are the corresponding small and large pumps placed near the opposite end of the cistern. Each pump is provided with a foot valve at b b^1, and the plungers or rams of each pair of pumps are both connected, as shewn, to the same crosshead, n and n^1. The double links, E E^1, connect the two crossheads to the lever, F, on opposite sides of its working centre or fulcrum, G, supported in a column, J, placed between the two sets of pumps, as seen in fig. 1. The crossheads, D, D^1, are guided vertically by the guide rods, H, working in the guides, I, carried by the pedestal, J, supporting the lever. Motion is imparted to the lever, F, from any prime mover by a crank and connecting rod jointed to the end, f, or other convenient part thereof, by a ball and socket, or other suitable joint. The large and small pumps on opposite sides of the fulcrum are connected by the pipes, K and K^1, which communicate respectively with the single stops at L and L^1, thus the pumps, B and C, are connected by the pipes, K, which meet at the stops, L, whilst the pumps, B^1 and C^1, are similarly connected by the pipes, K^1, meeting at the stop, L^1. The stops are opened and closed as required by the handles, M M^1, so as to bring the pumps into communication with the single presses, or to shut the pumps and open a communication from the presses to the cistern, a passage being made leading thereto from each stop, which is so arranged that when elevated the passage leading to the cistern from the press is open, and when lowered this passage is closed, and the liquid from the pump is made to pass round the spindle of the stop and enter the pipe, N or N^1, leading to the press in connection therewith. O O^1, are the ordinary safety valve levers in connection with the large pumps, as is well known in this description of machinery, and P P^1, are the levers of the safety valves belonging to the smaller pumps.

Fig. 1.

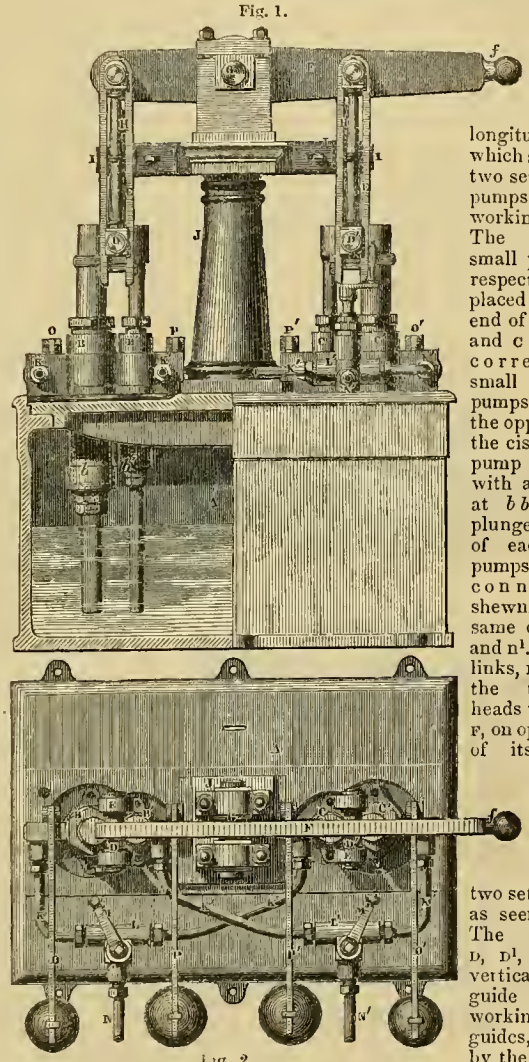


Fig. 2.

By the employment of this invention the patentee is able to use four pumps in connection with one double press, thereby obtaining the continuous action hereinbefore described.

COVERINGS FOR THE ENDS OF CIGARS.

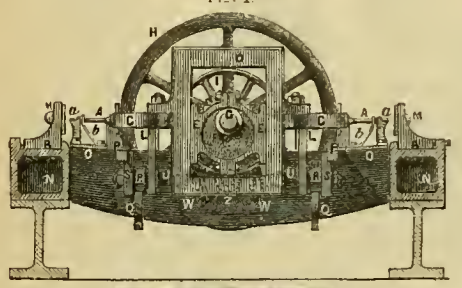
William Betts.—*Patent dated December* 19, 1861.

This invention comprehends a peculiar mode of manufacturing soft metal coverings to be applied to those ends of cigars which are inserted into the mouth, for the purpose of protecting the same from injury when smoking, and for dispensing with the necessity for twisting the leaf at the end of the cigars.

According to this invention, it is proposed to manufacture these coverings in a stamping machine, constructed on the principle of the bottle capsule machines, which are now well known and extensively used, but with such modifications that great rapidity of manufacture may be combined with little or no waste of material, so that the cost of manufacture may be reduced to a minimum. The coverings are stamped out of discs of soft metal, which may be either perforated in the centre before being introduced to the punches and dies, or perforated during the process of stamping by having the punches or dies provided with suitable pincers. Any suitable soft metal may be used in the manufacture of these cigar tips or coverings, but it is more particularly intended to employ for this purpose the material employed in the manufacture of bottle capsules, known as Bett's metal.

Fig. 1 of the subjoined engravings is a transverse vertical section of the stamping machine suitable for making these cigar tips; and fig. 2 is a plan of the same, corresponding to fig 1; fig. 3 being a complete, full-sized side elevation and plan of the cigar tip detached. In figs. 1 and 2 A are a number of horizontal punches and stampers, and B are a corresponding number of matrices or dies, these punches and dies being so shaped as to stamp up the cigar tip to the desired form from a flat disc of soft metal, the tip being transferred from one punch and die to another, until it has passed through the entire row or series, two of such rows or series being provided in the same machine. The punches, A, are carried by the two plates, C, which are connected together by the metal frames, D, within which work the two eccentrics, E.

Fig. 1.



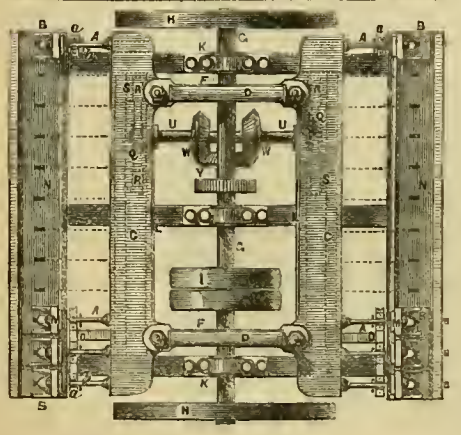
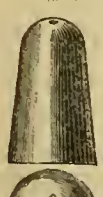


Fig. 2.

These eccentrics are embraced by the collars or straps, F, which are free to slide inside the frames, D, and accommodate themselves to the positions of the eccentrics during their revolution. The eccentrics, E, are keyed on the driving shaft, G, which is provided with fly wheels, H, and fast and loose driving pulleys, I, and works in ordinary bearings in the plummer blocks, K. The rotation of the eccentrics, E, imparts a to and fro horizontal motion to the frame and plates, D and C, sliding upon the supporting blocks, L, and also to the punches or stampers, A. The dies or matrices, B, are contained in suitable holders or brackets, M, fixed to the longitudinal beams, N, of the main framing. Immediately in front of each series of dies there is a carriage, O, (shown more clearly in figs. 1 and 2), supported by the longitudinally reciprocating bar, P, which receives a reciprocating motion in a longitudinal direction equal to the distance from centre to centre of the punches in each row or series, by means of the eccentrics, Q, rotating between the antifriction rollers, R, carried by the brackets, S, secured to the bars, T. These eccentrics, Q, are carried by the two separate cross shafts, U, which carry each a mitre wheel, W, gearing into a third mitre wheel, Y, fast on a short shaft of its own, each shaft receiving its rotatory motion direct from the main driving shaft, G, through the intervention of the spur wheels, Z. The disc of soft metal to be manufactured into a cigar tip is dropped into a suitable mouth-piece or receiver immediately in front of the first one of each series of dies, and is held there until the advance of the plate, C, causes the corresponding punch or stamper to force it partly into the die behind it, thereby slightly dishing it at the centre. As the punch recedes it carries back with it the partially stamped disc, and deposits it between the fingers or holders, *a*, on the carriage, O, a stripper plate, *b*, forked at its upper end, serving to strip off the partially formed capsule or tip from the end of the punch, as the latter continues to recede. In the meantime, a fresh disc is dropped into the mouth-piece again, and the carriage is slid longitudinally, so as to present the partially formed cigar tip in front of the second punch and its corresponding die, so that at the next forward stroke of the plate, C, it will receive a still further setting up in the die, whilst at the same stroke the disc last supplied receives its first impress, and so on, a constant succession of discs being fed in and passing through the machine, until they are delivered by the last punch or stamper of each series in the form represented in fig. 3.

Fig. 3.



In order to avoid unnecessary repetition and complexity in the illustration, only a portion of the several punches, or stampers, and dies, are shown, the positions of the rest being indicated by dotted centre lines; and, for the same reason, it has not been considered requisite to repeat many of the working parts in the figures.

REVIEWS OF NEW BOOKS.

Results of an Experimental Inquiry into the Comparative Tensile Strength and other Properties of various kinds of Wrought Iron and Steel. By David Kirkaldy. Bell & Bain, Glasgow. 1862. 8vo.

This is a thoroughly painstaking, able, modest, and elaborate work, and one that makes a very valuable addition to the stock of engineering data.

The author, in his preface, gives a simple, straightforward account, of the circumstances which led to his laborious experimental inquiry. He was, as we gather, in the employment of the well-known firm of Robert Napier & Sons, when, in 1858, circumstances caused them to desire to employ constructively homogeneous metal, or puddled steel—in certain cases where lightness and strength were to be combined; both were then comparatively little known in these countries, and experimental inquiry appeared desirable before adopting these new materials.

The experiments were intrusted to Mr Kirkaldy; and that he is one of those exact, scrupulous, painstaking, keen-eyed, and conscientious, labour-loving men, who are just the right stuff to conduct, with patience and precision, such experiments to a conclusion, every competent mechanic will know, who had the good fortune to see his exquisite mechanical drawing of the steam-ship *Persia*, built by Napier & Sons, which was exhibited a year or two ago in London, and was the first mechanical drawing that was ever permitted to hang upon the walls of the Royal Academy, and take rank, as it most truly did, with a work of fine art. The drawing may now be seen in the Civil Engineering class of the Exhibition at Kensington. The original experiments were subsequently extended to boiler plate, and other iron, to be employed in the armour ships, *Black Prince* and *Hector*, and afterwards still further enlarged; Messrs Napier, with a liberality that does them credit, being at the cost of the apparatus and so forth, but leaving Mr Kirkaldy perfectly free to the course of experiment and its management which he adopted. The first portion of the results was communicated to the Institution of Engineers of Scotland, and was published in its transactions. A further portion was afterwards presented to the Scottish Shipbuilders' Association; and now these, with a considerable additional mass of previously unpublished results, are given to the public in a separate volume.

The author states that, while giving his own results, and the inferences to which they may lead, he has considered it desirable to adduce, with the latter, the opinions of others, bearing upon former experiments. As respects his own experiments, he says he has confined himself strictly to such conclusions as he believes fully warranted by them—a statement, in which, so far as we have been enabled, to examine so vast a mass of facts, we are prepared to agree.

The work commences with Sections I. to XIX of preliminary remarks, in which, the mode of collecting the specimens for experiment, to insure their being of *average market qualities*, their preparation, the apparatus employed, the mode of conducting the trials, and the effects of various conditions, in the subjecting the metals to trial, are described and discussed, and a very good summary given, of the results obtained by previous experimenters. To this we must make one slight exception; the writer does not seem to have been acquainted with Mr Mallet's experiments on the co-efficients of strength and of elongation in *large masses of forged wrought iron*, and certain ones on puddled steel, published in the Minutes of Proceedings of the Institution of Civil Engineers, London,

about two years ago, and for which the author was awarded a Telford medal. This is the rather to be regretted, as Mr Kirkaldy appears to have himself made a few experiments, on pieces cut from a large crank shaft forging, which, although they appear all very weak, exceed the results obtained by Mr Mallet; and we should have been glad to have had the author's observations on both sets of results.

Except the experiments of Hodgkinson, none of equal value with these have been made by any British experimenter on the strength of iron. Mr Kirkaldy's labours have been extended in some directions not before attempted, amongst the most important of which are, his results as to the comparative strength of chased and screwed bolts, and of welded joints, as compared with the metal itself, thus united. To give an adequate notion of the mass of tabulated matter comprised in this well-printed volume, would need extracts of a length that our space forbids. We have no doubt that Mr Kirkaldy's labours will be found to have entitled him to a place amongst the standard authors of one of the most valuable classes of our engineering constants.—Ed.

Roads and Rails and their Sequences, Physical and Moral. By W. Bridges Adams, Engineer, London. Chapman and Hall. 1862.

This popularly written volume contains a great deal of information touching one of the most remarkable features of modern civilisation. It is from the pen of a man who has been studying practical mechanics throughout his life, with a view to the improvement of the arts by which the conveniences of human existence may be increased; and his book naturally contains not only criticism on the past, but fertile suggestions for the future. It is a book, therefore, that ought to be widely read. The following short extract, relating to the sewing machine, will give some idea of the style and tone of thought:—

"Verily, true engineering is a many-sided thing. It scorns nothing as too great or too small. It is the conversion of matter to men's uses by processes of what is called art, but which really is nature. Nor is there really any distinction between mechanical and civil engineering. They are merely gradations. Many were the days that elapsed from the inauguration of the first wooden needle to the bright, glittering, tiny thing of polished steel, that knew no rest in the hands of the shirt-makers, who earned sixpence per day under the modern Mosaic dispensation; a veritable metallic bar so light that it can almost float in water, and yet is a cone and a cylinder and a portion of a sphere, and has two channeled excavations and an elongated perforation, and is so rounded in the 'eye,' that the thinnest thread is uncut by the tensile strain of drawing together woven fabrics; and marvellous as this is, what a stride was it found when a variety of this needle was taken and made the tool of a machine that might be worked by the hand of a blind man or by steam, and never torture the eyesight of man or woman worker. How much greater a stride shall it be when the same machine shall be almost extinguished, and made useless by the steam-working machine, that will give forth not broad cloth and calico in flat webs, but the very garments themselves—flowing robes, or succinct tunics, for the philosopher and for the athlete, for man and woman and child, stamping a costume, graceful as ever dreamed of by the poets and artists of elder Greece, and withering up the uncouth monstrosities engendered by idle wantonness.

"This, too, in engineering, more original than the imagination of a crude sea-monster—an imperfect compilation of form and matter and machines; the creation of a Frankenstein rather than of perfected art—the incarnation of 'bigness'—bigness without completeness; bigness to astonish rather than to fulfil; bigness to consume much material, like the idol Bel, to consume much meat; bigness to set the iron-masters earving, but not fulfilling all the conditions required by those 'who go down to the sea in ships.' Verily, and in truth, there is engineering in earnest and engineering in sport, or for profit, like the prestigiation of a gambler, in which the artist is overwhelmed by the necessity of conforming to the success of the money speculation."

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

FIRE-ESCAPES.

Sir,—The perusal of the account of the dreadful fire in Cumberland Street has suggested to me the possibility of building fire-escapes on the outside of every house, and in the case of large houses, on two sides. It does not appear to me impracticable to build a shaft of brick or stone on the outside of a house in such a manner as to secure a safe descent from each floor, to which I propose access should be given by a door. In the case of houses with many stories a separate shaft might be taken to each floor, and to ensure greater safety, stages might be placed in the escape.

If architects and persons practically acquainted with fire-escapes would confer together, I believe some contrivance of the kind suggested could be adopted, and, if so, would be the means of saving many lives.

To prevent access to the house through the shaft from the outside, on ordinary occasions, the keys of the exit door on a level with the ground or area might be hung within reach of the inmates upon each floor, and could, in cases of great danger, be thrown from the window to persons outside, but the lower door might be opened from the inside either by a key or spring.—I have the honour to be, Sir, your obedient servant, H. M. V.

The preceding letter is one of many that have appeared in the leading journals recently, suggested by the several fatal fires lately in London. Fire-Escapes have so long and so periodically been brought before the public that attention is well nigh tired and dead to them. Yet it is, in its literal sense, of vital importance, that every house, especially in towns, should possess effectual means of escape from fire; and we really do not see why the existence of such should not be made legally imperative, and enforced by visitation of the police. We undertake to say that at this moment there is not one house in fifty in and about London in which constructively there is even a reasonable chance of escape for the inmates sleeping in it, from conflagration. One of the best Fire-Escapes for private use,—the simplest and the cheapest, we believe, yet devised, was one of those invented and patented by the late Joseph Bramah, and we commend it to the notice of the public. It was applicable to any pre-existing house. Nothing that involves "shafts" or other expensive additions or structures, is of any practical utility in the premises.—En.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the last ordinary monthly meeting of the Executive Committee of this Association, Mr Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month the ordinary visits of inspection have been made and 8 boilers tested by hydraulic pressure, the following defects being discovered in the boilers examined:—Fracture, 3 (2 dangerous); corrosion, 26 (6 dangerous); safety-valves out of order, 14; water gauges ditto, 10; pressure gauges ditto, 13; feed apparatus ditto, 4; blow-off cocks ditto, 37 (1 dangerous); fusible plugs ditto, 6; furnaces out of shape, 3; blistered plates, 2. Total 118 (9 dangerous). Boilers without glass water gauges, 4; without pressure gauges, 16; without blow-off cocks, 11; without back pressure valves, 31.

"The principal cases of dangerous injury which have arisen this month have been due to corrosion, the continued recurrence of which shows the importance of having all boilers examined, not 'Externally' only, but also 'Internally and Thoroughly.'

"Another explosion has occurred during the last month to the class of plain, cylindrical egg-ended boilers, fired externally. The boiler in question, which was not under the inspection of this Association, was one of a series of six connected together, in the midst of which it had worked, being the fourth from one end, and the third from the other. Its length was 30 feet, its diameter 5 feet, the thickness of its plates 3-8ths of an inch, and its working pressure 50lb. The rent, as is usual in these cases, occurred at one of the transverse seams over the fire, but the development of the line of fracture was somewhat peculiar. In ordinary cases these boilers, on explosion, separate at one of the ring seams into two distinct halves, which fly in opposite directions; but in the present instance, the first belt of plates was completely severed from the remainder of the boiler and flattened out, having rent through the line of rivets at each of its four edges, while the egg-end had become entirely disengaged from it, and, in addition, was torn into two parts. The remainder of the boiler, which was by far the greater portion, being about twenty-four feet long, had flown to a distance of from eighty to ninety yards, and the chimney, which was reduced to a heap of ruins, had either been swept down by it in its course, or blown down by the impact of the steam.

"There was no evidence of there having been either deficiency of water or excess of pressure; while each boiler in the series was fitted with two lever safety valves of three inches diameter, a glass water gauge, and a back-pressure feed valve. The exploded boiler was about four years old, and had been repaired

seven months since, at the part immediately over the furnace by the introduction of two new plates.

"It will be observed that the above explosion is another instance of the liability of these externally-fired boilers to rend at the transverse seams over the fire. The combined duty thrown upon these seams is so great, that there is more uncertainty with these boilers than with those of the internally-fired double-furnace class in ordinary use in Lancashire. All the points in the latter can be so entirely mastered that they may be thoroughly relied on, and if well-made, and in sound condition, can, with proper care in working, be guaranteed as safe for a period of twelve months from the time of examination. Not so, however, with the externally-fired boiler, in which the shell has to endure the entire disruptive strain combined with the direct impingement of the flame. In the internally-fired boiler these two duties are divided; the shell which bears the tensile strain, being guarded from the intense action of the fire, which the furnace-tubes are adapted to bear, from their small diameter and facility for strengthening, either by flanged seams, hoops or otherwise; while the deposit, which to a great extent rolls off the furnace crowns, and falls harmlessly to the bottom of the boiler in one ease, deposits itself immediately over the fire in the other. Thus the seams of rivets in externally-fired boilers have to contend with the combined influence of tensile strain, the direct action of the fire, and too frequently with an accumulation of incrustation tending to overheating, and even where this does not form a positive coat, it may yet suffice so to thicken the water that the steam lifts it from the surface of the plate, when over-heating unavoidably ensues; added to which sudden draughts of cold air, on opening the furnace doors, cool the outer laps of the plate at the seams, which thus become subjected to the constant alternations of expansion and contraction.

"Under these circumstances it is not surprising that the seams of rivets in under-fired boilers should frequently be found suddenly to give way, for which the surest remedy will prove to be the substitution of internally fired boilers in their place. Where, however, those externally fired are still adopted, it is earnestly recommended, in the first place, that good materials and workmanship should be secured; in the second, that every means should be adopted for the prevention of incrustation; and, in the third, that the seams of rivets should be constantly and narrowly watched, so as to detect the first signs of weakness, which should be immediately repaired.

"Ready examination is facilitated by setting these boilers, as some of our members are doing with a single direct flash flue, in which are a series of bridges, one behind the other, for keeping the flame in contact with the boiler; an entrance being made beneath the furnace bars, as well as a small archway through the back bridges, to allow of a communication throughout."

THE DEVONSHIRE ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

This Association recently held its meeting at Exeter, under the Presidency of Sir J. Bowring, having for his Vice-Presidents the Mayor of Exeter, Sir Lawrence Palk, Bart., Mr A. H. A. Hamilton, President of the Exeter Natural History Field Club, and Dr Shapter. At the first meeting of the Society, the President read his inaugural address on the advantages of such local societies in bringing together men of congenial minds, from distant parts of the country, who would otherwise probably never know or meet each other. Sir John gave a popular account of the discoveries in Science and the progress made in Art and Literature. On the second day papers were read: "On the Statistics of the Deaf and Dumb," by Dr Scott,—"On the Bovey Lignite Deposit," by Mr W. Pengelly,—"On the Ferns of South Africa and a Comparison with the Aerogenous Plants of Great Britain and North America," by Mr W. S. M. D'Urban,—"On a Sand-bed (or raised Beach) at Bovisend, Plymouth," by Mr Spence Bate,—"On the Relations to Literature of a Provincial Association for the Advancement of Literature, Science and Art," by the Rev. E. Risk,—"Age of the Dartmoor Granite," by Mr W. Pengelly. In the evening the Society was entertained by the Graphic Society at a Conversazione in which the Art and Science of Exeter were chiefly exemplified. The next day the Society made an excursion to Bovey Tracey, and examined the beds of lignite, under the direction of Mr Pengelly. Next year, the Association will hold its Congress in Plymouth.

ROYAL SOCIETY OF EDINBURGH.

The Keith biennial prize has been awarded Mr John Allan Broun, Director of the Trevandrum Observatory, for his papers "On the Horizontal Force of the Earth's Magnetism," "On the Corrections of the Bifilar Magnetometer," and "On Terrestrial Magnetism generally."

MONTHLY NOTES.

THE OFFICIAL TRIALS OF THE BLACK PRINCE.

The trial of the speed of this noble vessel, at full power, at her deep draught of water for sea service, commenced at Portsmouth, August 26, under the most favourable circumstances of wind and weather. The two previous trials of the ship took place at light draught, and under somewhat exceptional circumstances, the first only being a trial of speed, made on the day after her arrival at Spithead from Greenock, on the 20th November, 1861. The second was her trip outside the "Wight," to test the action of her enlarged rudder, in April last. In her speed trial she made four runs at the measured mile, with the following results in knots:—First run, 15·859; second run, 12·950; third run, 15·319, and fourth run, 13·043. Some disappointment was felt by many at the time, at this rate of speed, the *Warrior* having exceeded it on her trial at deep draught, when she averaged 14·354 knots. Various causes were assigned to account for the difference between the two ships, but, perhaps the real cause lay in the pressures of steam on board each vessel during the trial. At any rate this could be met and disposed of in the trial of yesterday. The ship's draught of water on the 20th of November was 24ft. 2in. aft, and 21ft. 10in. forward. The second trial (not of speed) took place in April last, when the ship was taken off the Culver cliffs at the east end of the Isle of Wight to test the capabilities of her rudder, which has been enlarged from one area of 130ft. to 153ft. On this occasion she had 12 men at her wheel, and, taking three of the circles completed by the ship as the average of the whole, they were made respectively in 8 min. 5 sec., 9 min. 49 sec., and 9 min. 38 sec.,—the angle of the rudder being in each case 16, 13, and 13 deg. The ship's draught of water was—forward, 22ft.; aft, 23ft. 1in. The *Black Prince* has now, however, made her trial of speed on equal terms with her sister ship, the *Warrior*, tried on the 17th of last October. The *Black Prince*, so far as appearances are of value, has enjoyed a great advantage in being fitted after the *Warrior*, all the little errors unavoidably committed in the former's fitment having been avoided in that of the latter, while many improvements suggested by the experience gained in fitting out the one ship have been applied to the benefit of the other.

Aloft, the *Black Prince*, like the *Warrior*, since her cruise in the Bay of Biscay, looks anything but ship-shape to a nautical eye, in consequence of her reduced bow-sprit. The original bow-sprit was 49ft. in length, and 40in. diameter, but this was reduced before taking it on board, to its present dimensions—25ft. in length and 24in. diameter. Other external fittings of the ship, including additional catheads which will carry the bower anchors some 20ft. further aft when at sea, bow linings of iron plate to preserve the ship's bows from the chafe of her anchors, and "heads" abreast the funnels for the use of the crew at sea, have been added in a similar manner to those of the *Warrior*. The additional catheads are however, something different in construction. The *Prince's* were made in Portsmouth dockyard. Their length is 15ft. each, width at top of sheave holes 14 inches., at bottom of riveting to the ship's sides 21½in., breadth of side plates at widest part 26in., and ⅞in. thick, thickness of outside plates for sheave holes 1⅛in., angle iron for framing 4in. by ⅞in. thick, angle iron to form connexion with side of the ship 5in. by ⅞in. thick, diameter, of rivets 15·16in., cathead, 45 cwt. The *Warrior's* are of a rather lighter character, and were made at Keyham factory. The armour plates on the *Black Prince's* sides are of two descriptions. Those bolted on her line of ports, each port being in depth just the width of the armour plate, are rolled plates, manufactured by Messrs. Beale & Co., of Parkgate Works. The remainder are hammered, manufactured by Messrs Rigley, of the Parkhead Works, Glasgow. Inboard the *Black Prince* has also been generally fitted on the same plan as the *Warrior*, with here and there a deviation which the experience gained from that ship has suggested. The work done in the shipwright's department has been very extensive, as the ship arrived at Portsmouth from Greenock in a very unfinished state. In connection with the engineering department, an auxiliary engine has been fitted of 40-horse power for working the capstan, pumping water from the different compartments, washing decks, and also to act as a fire-engine. A cupola furnace and fan has been erected for molten iron shell. Tramways in coal-boxes and stokeholes, with engines for raising ashes, &c., and a feed engine for the auxiliary boiler have also been fitted.

The ship's upper deck, being free from any rifle tower, such as encumbers the deck of the *Warrior*, presents a fine roomy space to the eye, and the sheer of the hammock rail forward and aft, to which we have before alluded, gives her a much smarter appearance than the *Warrior*, on deck. Here she carries two 110-pounder Armstrongs, four 40-pounders and two 20-pounders, also Armstrongs, besides rifled and smooth-bore guns for boat service. On the main deck she carries, in the two compartments, forward and aft of her armour plating, eight 110-pounder Armstrongs—four in each compartment. Behind her armour plating all the guns are the 95 cwt. smoothbore, for 68-pound solid shot, mounted on carriages fitted with directing bars. On deck and below, in every part, the ship, considering the large number of dockyard men that has been daily employed on board, and the amount of work which has been in hand at one time, is in an exceedingly clean and orderly condition, and reflects credit upon her captain and officers for their management.

The ship was appointed to have her anchor short a-peak at Spithead by 9 30 a.m., and at that time the *Pheasant* gunboat embarked from the dockyard Captain H. Broadhead and the officials appointed to execute the trial, and conveyed them out to the ship, which tripped her anchor at 10·30. In running the anchor up to the bows, however, by the steam capstan, the chain became jammed round the base of the capstan, with the ring of the anchor at the hawse pipe, and the auxiliary engine in consequence set fast below. This caused a considerable delay, and after this had been remedied, in bringing the ships head round to the westward to go on the "mile," the screw steering apparatus was found so deficient in direct power upon the rudder that the ordinary tiller had to be shipped and connected with the common wheel, and both worked together. This made it afternoon before the ship reached the trial ground, where four runs were made with the following results:—

	Time min.	sec.	Speed in knots.	Revolvs. of engines.	Steam.	Vacuum for.	aft.
First run	4	21	13·846	47·5	20lb.	25	23
Second run	5	58	18·055	49	"	25	23
Third run	4	9	14·457	49	"	24	23
Fourth run	5	50	10·286	49·5	"	24	23

Mean speed of the four runs 12·209. This result was so unsatisfactory, as compared with the *Warrior's* trial, that ship having attained a mean speed of 14 354

knots, that it was resolved to abandon any further trial of speed, and to recommend to the Admirality that the ship should be taken into the harbour and placed in dock to clean her hottom, and that the weight on her safety-valve should he increased to a level with that given to the *Warrior* on her trial trip, the *Black Prince* having been worked yesterday with 5lb. less than the *Warrior*. The screws of both ships are percisely similar, improved Griffith's, and set at the same pitch; the draught of water of the two vessels was however different. and against the *Black Prince*, whose draught was 6ft. 10in. aft, and 26ft. 2in. forward, the *Warrior* drew 26ft. 5in. aft, and 25ft 6in. forward There is certainly a vast difference in the speed of the two ships, which is not accounted for either by a foul bottom or the increased draught of water. Looking however, to the load on the safety valve in the two trials, we find in the five pounds difference in favour of the *Warrior* the cause of her at present superiority over the *Black Prince*; hut with a clean bottom and this difference in the weights rectified, it is expected that on the *Black Prince* resuming her trial, which it is intended she shall do this week, the speed of both ships will be found to he as nearly as possible equal. The determination having been arrived at hy Captain Broadhead to postpone for the day any further trial of the ship's speed, she was taken off the trial ground and steered for the Bembridge light-ship, to test her time in making complete circles to port and starhoard. On reaching the desired position the vessel's helm was put hard to starhoard, the ship at the time going at full speed, and the time heing taken from the word of command being given. The half circle was made in 5 min. 4 sec., and the full circle in 10 min. 11 sec., the angle of the rudder being 10½ deg. Two and a half turns were got with the wheel, and the rudder was hove into position in 1 min. 3 sec.; revolution of engines, 45·5. With helm to port, the rudder was hove up to an angle of 16 deg. in 33 see., with 3¼ turns of the wheel. The first half of the circle was made in 7 min., and the full eircle completed in 13 min. 33 sec.; revolutions of engines, 45·5. In the third trial the engines were stopped and the helm put over to starboard before starting, and the circle was completed in somewhat less time. In the fourth trial with the rudder amidships, the order was given to hard-a-port, aud the rudder was hove over by the screw steering apparatus to 11 deg., the extent to which it could he got hy this purchase, in 1 min. 20 seconds. The ship's head was now turned towards Spithead, and in steaming in to the anchorage the engines were tested in their powers of changing their motion when at full speed. From the time of moving the handle of the telegraph on the hridge, to give the signal to the engine-room, they were stopped dead in 19 seconds, and were started a-head from standing still in 11 seconds. and to going a-head at full speed in 32 secouds. The temperature averaged during the trial was as follows:—After stokehole, 106 deg.; fore stokehole, 90½ deg.; engine-room, 96½ deg. No vibration whatever was felt in the ship throughout the day's trial. Even on the hridges nothing was felt beyond the slightly tremulous motion of the plank flooring between the stanchions. The engines which were in charge of Mr Tucker, the chief engineer of the ship, worked smoothly and satisfactorily throughout, and the hoilers furnished a superfluity of steam.

Aug. 30th, the day appointed for her next trial at full power, having heen beautifully fine, with the wind light at N.E. off the land, the water almost without a ripple, Captain Broadhead, commanding Her Majesty's ship *Asia* and the reserve at Portsmouth, conducted the trial. As both ships were built from the same drawings, and their engines were made in one shop from one set of patterns, it might reasonably have been expected that the speed of hoth ships would have been as nearly as possible equal; hut the result of Saturday's trial has distinctively proved the *Black Prince*, under present eircumstances, to be fully a knot per hour inferior in point of speed to the *Warrior*. The results of the six runs of the *Black Prince* on Saturday were as follows:—

Run.	Time.	Speed in Knots.	Steam.	Vacuum.		Revolutions of Engines.
	min. sec.		lo.	Forward.	Aft.	
1	3 58	15·126	21½	24	24	52
2	5 5	11·803	"	24	24	52
3	4 5	14·694	"	25	24	51½
4	4 55	12·203	"	25	24½	51½
5	4 18	13·953	"	24¾	24½	51½
6	4 35	13·091	"	25	24½	51

Mean speed of the six runs, 13·317 knots.

It may be as well to insert here, by way of comparison, the result of the *Warrior's* six runs on her trial of speed. They were as follows:—

Run.	Time.	Speed in Knots.	Steam.	Vacuum.	Revolutions of Engines.
	min. sec.		lb.		
1	3 38	16·514			55
2	4 57	12·121			54
3	3 38	16·514	Equal to		54½
4	4 50	12·413			53½
5	3 43	16·142	*Black Prince's*		55
6	4 47	12·543			53½

Mean speed of the six runs, 14·354 knots.

By comparison of the two means it will thus be seen that there is a difference of speed against the *Black Prince* of 1,037 knots.

In seeking for the cause of this differencc several may he found, which, together or separately, will give a satisfactory reason for the apparent loss, although it, at the same time, will leave the *Warrior* as undeniably the faster ship of the two. There is a difference in the pitch of the two screws of about seven inches, and, with the *Black Prince* altered to this extent, it is calculated that she would increase the revolutions of her engines from her *maximum* rate of 52 to 54, or, perhaps, 55, the *maximum* of the *Warrior's*, which would give her at the same time an inerease of speed. Again, the *Black Prince* had on Saturday a mean draught of water of 7½ inehes over that of the *Warrior* on her trial, the former drawing 26ft. forward and 27ft. 2in. aft, while the latter only drew 25ft. 6in. forward, and 26ft. 5in. aft. This would necessarily add to the *Black Prince's* displacement, and to the amount of resistance she would have to overcome in passing through the water. It will also he in the recollection of all those interested in such matters that before leaving the Clyde the *Black Prince* grounded and heeled over considerably, eausing fears at the time that she had somewhat strained herself. We have before alluded to the slight disturhance in her port line, and there is little douht that she has dropped slightly at each end since receiving her weights on hoard. If the form of her bottom is at all altered, here alone is a sufficient cause to account for the loss of a knot per hour of speed. Looking at all these causes, however, a selection can only he fairly made of the 7½ iuehes extra displacement, and the difference in the pitch of the two screws as the true sources to which must he ascribed the *Black Prince's* defeat. This extra displaeement, however deserves some consideration. No reason eau be assigned, with any certainty of its correctness, for the *Black Prince's* draught of water exceeding that of the *Warrior*. Her auxiliary engines exceeded in weight that of the latter ship, but this the *Warrior's* Rifle Tower, with its 35 tons of armour plates, more than compensated. The hottom of the *Black Prince* must therefore be sharper than the *Warrior's*, must he thrown out of proper form, or her hottom plates must be considerably the heaviest. Over so vast surface the 32d part of an inch would make a great difference in the ship's weight. One thing is certain—this loss of a knot per hour of the ship's speed under steam is not due to her machinery, which fully maintained, hy its working on Saturday, the reputation of the eminent firm hy whom it was manufactured. The loss, then, is due, in some form, to the ship's hull; and to ascertain positively whether it is owing to the ship's immersion, or to her form of hottom, it would be necessary to lighten her, trim her to the same draught as the *Warrior*, set her propeller exactly to the same pitch, and try her again at the mile under, as nearly as could he done, the same circumstauces as attended the *Warrior's* trial. With reference to the speed of ships under steam generally, some misunderstanding appears to exist in the public mind. If a ship is stated to have made 14 knots at the measured mile many persons look upon this as denoting the ship's future speed at sea. Never was a notion more fallacious. From all speeds made at the measured mile 1½ knot may he deducted, the remainder giving the ship's best rate of speed at sea, with good fuel, clean fires, and the ship, in fact, "pushed" to do her best. Taking a ship's average speed at sea, two knots may he deducted from the measured mile rate. The reason of this is obvious. At the measured mile she hurns the hest picked fuel, her fires are attended hy a hody of experienced stokers from the steam factory of the dockyard, under their own foremen, and the trial is never made when important, like the *Black Prince*, except under the most favourable circumstances of weather. This explanation will account for the apparent discrepancy in the speed of the *Warrior* on her late run with the Lords of the Admiralty in their yacht *Osborne* down Channel and what she realized at the measured mile. When the *Warrior* made her 14·354 knots of the measured mile her average sea speed was set down at 12½ knots, and this, with a clean hottom, there is no douht is her true sea rate. Meanwhile, it is worth observing here that notwithstanding the numerous "infallihle" preparations for preserving clean the hottoms of iron ships there is yet a noble fortune to be won in that way.

The iron frigate *Black Prince*, Captain J. Y. F. Wainwright, eoncluded her trial of speed, as far as at present arranged, September 1, at the measured mile in Stokes Bay, near Portsmouth, at reduced boiler power. Captain Broadhead again conducted the trial, the timing of the ship at the mile and noting of the machinery being superintended by Mr Murdoch, Inspector of Machinery Afloat, and Mr Ward, assistant to the chief engineer of the dockyard; the engine room heing in the charge of Mr Tucker, the chief engineer of the ship. The first trial was made with six out of her complement of 10 boilers, heing six tenths of her power. Four runs were made as under:—

Run.	Time.		Speed in Knots.	Steam.	Vacuum.		Revolutions of Engines.
	min.	sec.		lb.	Forward.	Aft.	
1	4	55	12·203	19½	26 75	26 5	43½
2	5	40	10·588	20	26·5	26·5	44
3	4	38	12·950	20	26·25	26	44½
4	5	43	10·495	20	25·25	26	45

Mean speed of the four runs, 11·663 knots.

Two runs were next made with four boilers, four-tenths of the ship's power, with the following results:—

Run.	Time.		Speed in Knots.	Steam.	Vacuum.		Revolutions of Engines.
	min.	sec.		lb.	Forward.	Aft.	
1	4	52	12·329	20½	27	27	40
2	6	31	9·207	20½	27	27	40½

Mean speed of the two runs, 10 768 knots.

VEGETABLE FIBRES.—Mr John Thompson of the Seafield Works, Dundee, has lately inventcd a combination of certain chemical and mechanical processes

for the treatment of vegetable fibres, which has caused much excitement in the manufacturing world. The method is applicable to the fibres of jute, flax, tow, codilla, manilla hemp, and other hemps, but its principal application at present has been to jute, (an Indian plant belonging to the same family as our lime tree), the price of which has risen greatly in the market. Its fibre can be made to resemble that of cotton, wool, or silk, and it becomes well adapted to the manufacture of textile fabrics either alone or mixed with other and more costly materials. The invention has been provisionally protected under the patent laws.

The Emigration of 1861.—Of the emigrants from the United Kingdom in 1861—91,770 in all—49,764 embarked for the United States, 12,707 for British North America, 19.183 for Australia (14,256 of them for Victoria), 4,555 for New Zealand, 1,576 for the Cape, and 774 for Natal.

Sinking of Telegraph Cables.—An important improvement was introduced during the recent submersion of the additional cable just laid by the Electric and International Telegraph Company from Lowestoft to the Dutch coast. Fishing boats were stationed every five miles to prevent the waste of cable by the "slack" usually attendant on the ordinary process of submersion. It is understood that as much as five miles of cable were thus saved.

The Iron and Machine Trades.—The exportation of iron in its various forms experienced some reduction last year, the total value of the iron and steel sent abroad having been L.10,341,574, against L.12,154,997 in 1860. There was an increase in pig from L.974,065 to L.1,047,318; hut bar, bolt, and rod iron declined from L.2,385,871 to L.1,885,605; railroad iron, from L.3,408,759 to L.2,903,357; cast iron, from L.832,638; wire, from L.250,087 to L.207,317; wrought iron of all kinds, from L.3,317,349 to L.2,868,923; and unwrought steel, from L.986,228 to L.727,840. It was in 1853 that the export iron trade assumed its present large proportions, having increased in that year to L.10,845,422 as compared with L.6,684,276 in 1852, L.5,830,370 in 1851, &c. The value of the machinery exported last year was never exceeded in any previous 12 months, steam-engines having figured for L.1,243,467 and other kinds of mechanical apparatus for L.2,976,221, while in 1860 the totals were L.1,238,333 and L.2,599,488 respectively. In 1850 the value of the steam-engines exported was only L.423,977, and of the general machinery L.618,189, so that during the last 10 or 11 years a vast development has taken place in the demand for British machinery in foreign countries and in the colonies.

London Joint Stock Banks.—The following table shows the present position of the six principal joint stock hanks in the metropolis:—

Banks.	Year Established.	Paid-up Capital.	Current and Deposit Accounts.	Reserved Fund.	Nett Profits for Half-year end. June 30, '62.	Rate of Divid. & Bonus per Annum.	Amount paid-up per share.	Price per Share.	Advance per Ct. in price.
		£	£	£	£	P Ct			
London & Westmin.	1834	1,000,000	14,353 034	250 000	121,538	20	20	79	340
London Joint-stock	1836	600.000	11,304,158	249,525	67,270	20	10	31	395
Union Bank of London	1839	720,000	11,415,320	50.000	75,529	12½	12	31	262
London and County	1839	571,895	7,702,170	175,000	40,681	10	20	39	197
City	1855	300,000	3,449,540	60,000	15,611	10	50	91	183
Bank of London ..	1855	300,000	2,254 540	55,000	23,107	8	50	84	168
		3,491,895	50,478,762	839,525	343,729				

The Comet.—M. Petit, Director of the Observatory of Toulouse, has published the following particulars respecting this new visitor:—"The nucleus, which is now visible (29th August 1862) to the naked eye, resembles in size a star of the fourth magnitude, and is rendered somewhat faint by the coma, which on the 19th subtended an angle of four minutes, corresponding to a real diameter of 24,000 leagues, and to a volume 400 times larger than that of the earth. The tail is likewise perceptible, and will increase by the 31st inst. to double its present size, whereby the comet will become rather a conspicuous object in the heavens. It is now between the head of Ursa Minor and Draco, and therefore not far from the Polar star, and is moving towards Scorpio, where it will disappear towards the end of September. It will be visible to the naked eye until about the middle of next month, hut from the 31st inst. its brilliancy will rapidly decline while it traverses the constellations of Corona, Serpens, and Ophiucus. Its maximum proximity to the sun was 37,000,000 of leagues, and occurred on the 23d inst. On the 15th of September it will be at a distance of 40,000,000 of leagues from the sun. Its shortest distance from the earth will be 13,000,000 of leagues on the 31st inst., and 36,000,000 of leagues on the 24th of September, when its brilliancy will he reduced to one-fourth of what it is now. The friends of cometary astronomy will learn with pleasure that there is at present a second comet, though a very faint one, in the vicinity of the orbit of Mars, our nearest neighbour among the planets. It is 70,000,000 of leagues from the earth, and 53,000,000 from the sun, and may he found between Ophiucus and Sagittarius.

Paper.—Among the botanical specimens sent over from Japan to the Societe d'Acclimatation hy M. Eugene Simon, there are a few young trees out of the bark of which the Japanese make very good and strong paper. In China the hark of the *Broussonnetia papyrifera*, a kind of mulberry tree is used; that of Japan is a variety of the same species, to which Van Sieboldt has given the name of *Broussonnetia Kaminoki*. Considering the daily increasing difficulty of meeting the demand for rags, which are sold at about £2 per cwt., the hark of this tree, imported from Japan, would prove extremely valuable to the paper trade, inasmuch as it would not cost more than half that price. The *Broussonnetia Kaminoki* might he easily acclimatized in various parts of Europe; it prefers a stony soil, especially of a calcareous nature, and should be planted at intervals not exceeding three feet; otherwise the branches would extend, whereby the bark would become full of knots, causing much loss of substance in the manufacture. The soil is not manured until the second year; in the autumn of that year the plant is lopped close to the root, and this operation, as well as that of manuring slightly, is repeated every second year; 100lh. of branches thus obtained, stripped of their leaves, yield 10lb. of bark. The branches, on arriving at the manufactory, are put into hot water for half an hour; the bark can then be easily stripped off with the hands, and is afterwards left in the sun to dry. It is next macerated for three days in river water, and bleached in the sun. These operations having been several times repeated, the hark is at last hoiled in a lye of ashes for the space of three hours, then manipulated for some time to separate any epidermis that may have remained, and lastly, when dry, the mass is pounded fine and made into a pulp with water, to which a glutinous liquid, extracted from a shruh called *Neboorikо*—probably the *Acacia Nemu*—is added, in the proportion of ahout two pints per cwt. of pulp. The latter is then made into sheets much in the usual way.

Experiment with a Traction Engine.—An experiment of some interest, as illustrating the power of Bray's traction engine for drawing ponderous loads along our public thoroughfares, took place on 22d and 23d August. A large wrought-iron girder, of the hog back construction, 74 feet long, 5 feet 8 inches high in the centre, and weighing 20 tons, had to he removed from the works of Mr H. Grissell, Eagle-wharf Road, New North Road, to the Manor Road, Dulwich, where it is to form part of a bridge for the London, Chatham, and Dover Railway. The journey had to be performed hetween 10 p.m. and 6 a.m., the hours to which the use of traction engines is restricted by the police regulations within the metropolitan district. The huge, unwieldy mass, placed upon rollers, was raised by means of jacks to a height of six or seven feet from the ground. Two strong trucks were put underneath, the one in front being a large four-wheel boiler truck, and the second, which bore the weight behind, a very heavy "lorry" with two wheels. These trucks together formed the carriage, the girder being kept in its position hy stout chains passing over it and under the trucks. A wooden bolster was placed under the load on the larger truck, with a swivel hetween the fore and hind wheels, hy the action of which facility was obtained for turning corners with comparative ease. Naphtha lamps, to light the workmen and give warning to all passers-hy, were fixed along the whole line of the girder; and, thus equipped, with the traction engine yoked in front, the massive load went upon its journey. Indeed, so great was the curiosity to see it, and so deafening the shouting of the excited urchins who came thronging round it, that it was occasionally almost impossible for the workmen to understand the directions given. The moving mass went on to London Bridge, which was crossed in capital style. St George's Church, Southwark, was reached about midnight, and the real difficulties of the route were then all surmounted. It was daylight when the final destination (Dulwich) was attained.

Distance Measurers.—A contrivance for measuring distances, on the same principle, was devised about the same time by Professor Smyth, of Edinhurgh, and Professor Struve, at Pulkova, in Russia. In the latter country the authorities condemned the contrivance, ou the grounds which Professor Smyth has mentioned in his recently published hook on Russia. It could not he because the principle was deemed defective, for that he had mathematically demonstrated to be true; and surely not because the principle was inefficiently carried out in practice, for the optical work was in the highest style of finish peculiar to the best astronomical instruments. They began hy laying down the maxim, that any really good modern invention in Russia must have long since heen discovered in England; and, if discovered there, would, as an equal matter of course, have been brought into use by the British Admiralty. They had then, therefore, only to inquire whether any instrument like M. Struve's was presently employed in English men-of-war; and having found on inquiry that no such apparatus was now-a-days known there, they considered themselves to have arrived at an undeniable proof that the distance-measurer of the astronomer of Pulkova was not, and could not be, a good or useful invention. Some rumour of the matter above mentioned having chanced to reach the Grand Duke Constantine, a pratical seaman, at the head of the Russian Admiralty, he ordered all the parties down to Cronstadt, there to try the new instrument in his presence, and ascertain its capabilities in the open air. The season was winter, a Russian winter too; but under the Grand-Duke's supervision, long lines were soon measured over the ice in radiating directions from one of tbe outer forts; and on poles or other marks heing erected at the end of such lines, the distance of each object was instantly given hy a man with the new "distance-measurer," who did little more than merely look at them out of the cannon embrasures. These determinations being presently compared with the notes of chain-measurers on the ice, produced such a conviction in the mind of the inspecting chief, that he at once empowered the astronomer to construct a large number of his absolute distance-measurers for use in Cronstadt. Hence the Russian Artillery has now, most probably, a more exact, economical, and scientific means of measuring distance, than either army or navy of any other European power can show; unless, indeed, my friend Col. Henry Clerk, R.A., may recently have been allowed to hring into employment at Woolwich certain very similar contrivances of his own.

Paris Universal Exhibition.—This huilding, undertaken by a company, is now in progress, and is intended to be a permanent structure. The *Builder* supplies us with the following particulars:—It is situate at Auteuil, close to the road and railway, and just within the ramparts. The estimated cost of the building is £600,000, the whole of which has heen subscribed in France. The object is to found a place of resort for producers, dealers, and customers from all parts of the world, where commodities may be compared and purchased

under one roof. The shareholders are to be reimbursed by the rentals charged to exhibitors, and the public will be admitted free on at least five days of the week. The building is situate on an irregular-shaped plot of ground, bounded on one side by the new railway, on another by the road to St Cloud, and flanked by the ramparts. The main building will consist of an open nave, running north and sonth, presenting a clear and uninterrnpted space of 1050 feet long, 130 feet wide, and 110 to the crown of the semicircular roof, which springs at a height of 35 feet from the floor-line. This nave will be intersected by a transept of equal width and height, 550 feet in length, above which a dome will rise to a total beight ot 345 feet. The domes of the London International Exhibition building are 250 feet in height. On each side of the nave there will be aisles, 100 feet in width; and again, on the west side, two supplementary aisles of equal width, but of varied length, planned in accordauce with the site. Over all these aisles, at a height of 25 feet from the ground, galleries will be constructed. The total length of the building externally will be 1315 feet. At the south end, quite detached and yet connected with the main building by corridors, will he a polygonal saloon, 222 feet in diameter, and 115 fect in height. With its gallery all round, it is calculated to hold 10,000 persons. A machinery annexé, 600 feet long and 100 feet wide, will occupy the north-east corner of the ground; and near the music saloon will he erected two buildings, of iron and glass, to be used as winter gardens. The architect is Mr Liaudier; the contractor, Mr Edwards; and the iron castings are being made in Glasgow by Messrs T. Eddington & Son. The London agency is at 27 Leadenhall Street.

The Stevenson Memorial.—The Newcastle monnment to George Stephenson, the great engineer, was completed last week, and will he shortly inangurated by Lord Ravensworth. It has been erected in Neville-street, closely adjoining the Central Railway Station, and consists of a massive stone pedestal bearing a colossal statue of George Stephenson by Lough, together with certain emblematical figures, viz., that of a blacksmith naked to the waist, sitting and leaning against an anvil, while his right hand grasps a hammer; a pitman, carryiug a "Geordie" lamp; a platelayer, ho ding a model of Mr Stephenson's old fish-bellied rail; and an engine driver leaning against a locomotive. The monument promises to be very effective, and a great ornament to the town. The monument to the late Mr Robert Stephenson will be placed nearer to the railway station.

Cultivation of Tobacco.—The present Australian advices mention that a movement was on foot to introduce the cultivation of tobacco, for which the climate and soil are considered hy many persons to be eminently suitable. The Board of Agriculture in Victoria have offered a premium of £40 for the best sample. The average annual value of tobacco and cigars imported into the colony of Victoria during the last five years has been £212,000, and the hope is that not only this quantity may be obtained of colonial growth, but also a large surplus for exportation.

Preservation of Stone.—Mr A. Church's method, which is likely to meet with much favour, is as follows:—The stone to be preserved is first brushed over with a solution of pure baryta, until it ceases to be absorbed, and, a few hours after, with the solution of silica, obtained by decomposing silicate of potash, or soda, with hydrochloric acid, and then dialysing, so as to get rid of chloride of potassinm, or sodium. The result of the mutual reaction of these two solutions is that a perfectly insoluble silicate of baryta is formed in the substance of the stone, which resists all atmospheric and hygrometric influences. No soluble or destructible materials are introduced into the stone to be preserved, a point of very great importance.

Metropolitan Gas Companies.—The total paid up capital of the thirteen gas companies of the metropolis amounts to £5,647,900. The total income from the sale of gas in 1861 was £1,385,592. Coals during that year cost £728,552, and £335,302 was received hy the sale of coke, tar, and ammonised liquor. The dividends have ranged from 6 per cent. to 10 per cent. The price of gas has been 4s 6d per 1000 cubic feet, except in the case of the South Metropolitan Company, which sells its gas at the rate of 4s for that quantity.

Seiler's Patent Hoisting Apparatus.—This apparatus is simply an aero-hydrostatical balance, the principle of which is based upon the displacement of water and of enclosed columns of air, in communication with each other hy a tube, and set in motion by a surplus weight, which consists generally, of a volume of water. It is proposed to be adapted to railways, canals, floating docks, warehouses, and other purposes. When ponderous bodies are to he alternatively and intermittently raised or lowered to or from either small or great vertical heights, such as, for instance, a whole railway train, there needs but a surplus weight of from 3 to 10 per cent. (according to the desired speed) of the whole weight to he hoisted or lowered, to enable that same weight to ascend or descend, whatever may he the space of time between each train. The surplus weight necessary to lower the balance may, in most cases, be procured from some rivulet or stream, made to accumulate its water in a reservoir; no matter whether it be at a much lower level than the ground on which the apparatus stands. Two working models, at $\frac{1}{20}$ of the full size have been erected and placed in the Exhibition. The first represents a bridge upon which stands a railway train, to be raised to a height of 115 feet in less than five minutes, and is made to work by means of a tube 100 feet in length, leading from an air-holder. The second model represents a double lock of a large size canal in France, and shows a difference of level of 65 English feet, which, with a weight of 2200 tons, is to be crossed within two minutes, by means of a surplus weight of only 50 cubic yards of water. There is no necessity even to make use of any of the canal water, as the surplus weight may be obtained from an airometer which may be placed where water is found. With regard to canal locks it is stated that whereas it takes a canal boat or barge several hours to go through these locks to reach the higher or the lower level, by this process it can never take more than 3 or 4 minutes, and whatever may be the height or difference of level to be passed, the loss of water cannot exceed 50 cubic yards. Any number of trucks, carts, waggons, &c., whether for loading or unloading, may also he hoisted or lowered to or from the level of every floor of a series of docks, warehouses, either simultaneously or alternately, hy means of two main air-holders operating alternately, and placed where water is found for the supply of the necessary surplus weight. It merely suffices to turn a cock to set any size hoisting apparatus in motion, or stop it.

The Maize Plant.—There is an interesting collection in the Austrian department of the Great Exhibition, of products made from the leaves of the Indian corn or maize. The head leaves are capable of yielding a nutritive substance fit for human food; a fibrous material capahle of being spun and woven like flax, and lastly, a pulp from which a most beautiful paper can be produced. The collection shows maize fibres prepared and spun into yarn, some woven fabrics made of the same, and several kinds of paper produced from the leaves of this plant. The whole mass of the head leaves, with very little waste, yields on an average one-third of its substance for spinning, one third for paper, and one-third for food. The whole of the fibrous substance may also be worked up into paper. The process as carried on in the Imperial Paper Manufactory at Schloegelmuehle, Lower Austria, gives a produce of 100lb. of paper from 300lh. to 350lh. of head leaves, irrespective of the other materials, and 1cwt. of such leaves costs only 6s. when delivered at the paper factory. To produce the same quantity of paper about 160lb. of rags would be required. According to official returns there are 35,000,000 acres of land in Austria planted with maize, the annual product of the head leaves from which is estimated at 2,750,000cwt. If the whole of this is worked up into paper the yield would be enormous, exceeding 1,500,000lh. annually.

Accounts of the Great Exhibition.—Allowing for errors, unavoidable in all estimates, we think that the following account will show guarantors how matters stand at present at South Kensington:—Estimated account of all receipts at the International Exhibition from the 1st of May to the 23d of August, inclusive: cash received at doors, £210,196; season tickets, £79,000; refreshment premiums, £5500; refreshment head money, £16,092; advertisements, £15,000; catalogues, £16,140; waiting rooms and umhrellas, £3471; photographic premiums, £2350; total, £347,749. The receipts in 1851, by the same date, even without such fruitful sources of profit as the refreshment contracts, had reached £387,936. From the 23d of August to Saturday, the 18th of October, the day on which the Commissioners will most probably close the building, gives forty-eight more exhibition days, and, allowing the receipts to be £3000 a day (a fair average) for each of these days, this will give the Commissioners nnother £144,000, making, with the £348,000 which we estimated in hand, £492,000. Messrs. Kelk and Lucas, under their contract, are empowered to draw all money received between £400,000 and £500,000 as rent for the building, giving up the picture galleries if they receive £100,000 from this source. In this case £92,000 will go into their pockets, leaving the Commissioners £400,000 to pay the following account:—First fixed payment of rent to Messrs. Kelk and Lucas for the use of the building, £200,000; huilding extras, £70,000; general expenses, £175,000; total, £445,000. This will leave an estimated deficiency of £45,000, to be made up by the guarantors.—*City Press.*—[As it has been determined to keep the Exhibition open to the end of October, this amount will be considerably reduced. —Ed.]

Cooking Apparatus.—Of cooking apparatus, we have not found in the Exhibition a single specimen of the very cheap contrivances which are used hy the poorer classes in Paris, obliged to live in small apartments. We know a court leading out of the Rue du Dragon, occupied chiefly by dealers in cheap stoves and articles belonging to the *batterie de cuisine*, which should be visited by every one taking interest in the question of metropolitan *logements*, and only for the sake of seeing how, by a slight change from the English system, good cookery, with variety in food, can be made within the reach of any working man's wife who would please to try whether that way of ministering to a natural demand is not hetter than the drinking way that is left substituted. Those who smile at the recommendation of French cookery for the very poor, may not know what that cookery is. French cookery is simply the variety; the preparation of *small pieces* of meat, of inferior quality perhaps, so as to he palatable; the getting full nutriment out of the meat by the manner of cooking; and the utilization of every scrap of bone for soup or sauce. Has any inhabitant of a sea-port, as Whithy or Scarhorough, thought of the waste of nutritious substance which goes on in the form of heads and bones of fish, cast daily on the beach? A good French *ménagère* will provide in fact, and as we have said in speaking of French *apartements*, soup. three courses, and a dessert, with the aid of a little nest of charcoal stoves. which is not larger than the smallest dressing-table, or may be 2 feet hy 1 foot on the top. It stands on four legs, so that it may be set almost anywhere; though it is well to place the contrivance under the hood with flue, which is generally built in some corner ready for it. Tho space of the top, not occupied by the little stove gratings, is covered with glazed tiles. Much smaller and more portable contrivances even than these may be had, better and cheaper than any we are acquainted with as manufactured in England. Cheap appliances which may help to render the poorer classes more comfortable, are about the most important objects that could be shown in an international collection of works and products which are brought together purely for the object of progress. More durable contrivances than those we have referred to, and wholly of iron, whilst some of them better adapted for roasting, may be had in Paris for from 30 francs (£1 4s.) upwards. The cheaper kind may have an oven and two apertures at top for boiling or stewing; a larger size is sold for about 80 francs (£3 4s.) Tho English cottagers' stoves, at about

the same price, but requiring to be set in brickwork, are, though larger, not so well-devised for convenience in cooking and for variety in food. The so-called American emigrant's stove, of which there are several in the British Division, is a superior thing, allowing of roasting, baking, boiling, and steaming by one small fire. Is must, however, be better adapted for open-air than for kitchen use, having the objection, which indeed may be made to French and Belgian forms, when English coal is used, that of making a kitchen too hot.—*The Builder.*

British Columbia.—British Columbia, once known as New Caledonia, contains about 200,000 square miles; the average breadth of the territory is about 250 miles; the length of its coast line about 450 miles. The population of the country is chiefly migratory, consisting of mining adventurers from California and other parts of the world, and including considerable numbers of Chinese; the settled white population may be estimated at under 10,000. In addition to its gold mines, which are as yet the principal source of wealth to the colony, the natural resources of the country have thus been summed up in evidence given before the House of Commons: —Its minerals are most valuable; its timber the finest in the world for marine purposes; it abounds with bituminous coal well fitted for steam purposes, from Thomson's River and Colville district to the Rocky Mountains, and from the 49th parallel some 350 miles north, a more beautiful country does not exist. It is in every way suitable for colonisation. There are three routes by which Vancouver's Island, and British Columbia may be reached. Firstly, round Cape Horn direct to Victoria, the capital of Vancouver's Island, a flourishing town of 3000 inhabitants; secondly, by the West India mail steamer to Aspinwall, thence across the Isthmus (48 miles) by railway, to Panama, and thence by the Pacific line of steamers to Victoria; thirdly, *via* New York to Aspinwall by steamers, and thence to Vancouver's Island across the Isthmus, as in the second route. This is the most certain route for letters. From Vancouver's Island to the mainland of British Columbia the distance is about 60 miles across the Gulf of Georgia. The time occupied on the first route is about five months in a sailing vessel, and about three in a steamer, the cost in the first cabin from £50 to £60, and in the second, or intermediate cabin, from £30 to £40, and in the steerage from £25 to £30. By the second route Vancouver's Island may be reached in about 50 days, if passengers are not detained at Panama and San Francisco. There is sometimes a week's detention at the latter place. The cost of a first-class passage is about £100, that of the second class about £65, and that in the steerage about £45. The cost of passages by the third route is about the same as by the second route.

Grinding Mill.—A new arrangement of mills suitable for grinding, splitting, or shelling seeds, and for other generally similar purposes, has been brought out by Mr Ballantine of Linlithgow. Under one arrangement the mill is supported on a framing of cast iron forming a table, on which the hopper and grinding apparatus is arranged. At the lower part of the framing, and extending across it is fitted a horizontal stay piece which forms a footstep bearing for a central vertical shaft This shaft passes up through the centre of the table, and its upper extremity revolves in a collar bearing, fitted in the lower part of the hopper, the shaft passing through a box within which the grinding discs are arranged. There are two of these discs arranged horizontally, and rotating one above the other, they are by preference formed of iron, with radial or other grooves in the working faces. The upper disc is fast to the central shaft, and the lower disc is carried on a tubular shaft which works outside the other. The central shaft is provided with the means of adjusting the distance of the discs, one from another; this is done by means of a screw, fitted at the lower end, for raising or lowering the shaft. Motion is given to the main shaft from a driving shaft actuated either by hand or power; near the inner end of this shaft is fitted a bevel spur wheel which gives motion to a pinion on the vertical shaft. On the extremity of the driving shaft, and inside the main spur wheel, is a second bevel wheel, which actuates the tubular shaft, carrying the other grinding disc. It is preferred to actuate this disc at a lower speed than the upper one, and when required the shaft may be readily thrown out of gear, by sliding the pinion up the feather formed on the tubular shaft. The materials to be ground are fed in through the hopper in the usual way, and pass down between the grinding discs, where they are subjected with more or less severity to the tritnrating action, according to the adjustment of the discs, which is suited to the material under operation.

Machine for Cutting and Scoring Pasteboard.—Mr J. G. Service, of Glasgow, has recently introduced a useful machine for cutting pasteboard to any required form, and for scoring or partially cutting through certain parts to admit of the pasteboard being readily bent up, to form for example, a box. The machine consists of a pair of open end standards, in which are arranged the bearings of a pair of rollers. Motion is communicated to the lower roller, either by hand or power, and this roller carries to and fro a table to which a reciprocatory traverse is imparted. In this table are fitted the knives for cutting the pasteboard to the required figure, these knives are made adjustable as regards height, by means of screws contained within the body of the table, so that the knives may be adjusted, either for cutting or scoring. As arranged for cutting pasteboard for box making, the knives cut the pasteboard to the required size, and cut out the corner pieces, whilst the central part which forms the top or bottom of the box is scored to facilitate the bending up of the pasteboard to form the sides and ends of the box. These knives may be disposed so as to cut one or more boxes at one operation from the sheet of pasteboard. The upper roller is fitted in bearings which are adjusted by means of a screw, so as to regulate the pressure of the roller upon the pasteboard, and the surface of the roller is covered with sheet of lead or an amalgam of that metal, so as not to injure the edges of the knives. When the table is run out to the end of its traverse, a sheet of pasteboard is placed upon the knives, and the table is traversed under the upper roller, the pressure of which causes the knives to cut the pasteboard to the required figure, whilst the central part is merely scored. When the table is traversed forward its extremity comes in contact with a lever which motion actuates a plate having a number of vertical pins projecting up from its face. This plate ascends sufficiently to allow of the pins coming in contact with other pins placed in the table, and these pins coming in contact with the pasteboard so as to release the several pieces from the recesses formed in the table by the arrangement of the knives. As the table traverses back again a brush roller or other equivalent sweeps the pasteboard into a box beneath. The several pieces for forming the boxes and lids are subsequently separated from the corners or waste. This cutting machine may be arranged to take on a sheet of pasteboard at each side of the rollers, suitable provision being made for clearing the cut pasteboard and putting on a new sheet at each traverse of the table, and thus producing double the quantity. Or instead of arranging the knives in a traversing table, they may be fitted in one of the rollers, and the pasteboard cut as it is passed between them. These machines are well adapted for cutting pasteboard for bookbinders and other generally similar purposes.

British Fisheries.—The annual report of the British Fishery Commissioners shows the great success of the new branding system. The fee of 4d a barrel for branding herrings yielded only £2644 in its first year, 1859; £3865 in 1860, and £4422 in 1861. Yet the fishing in 1861 was not extraordinary; the gross cure was less than in 1860, but the branding of the export exceeded those of 1860. 33,433 more barrels were branded, and the export reached 390,313 barrels. The Scotch herrings have in a great degree displaced those cured by the Dutch in the foreign markets where they meet, and last year upwards of 20,000 barrels were exported direct from Scotland into Holland—the commencement of a trade which, it is hoped, may in future years emulate that of the Prussian ports, and develop, as that did, from small beginnings into the large proportions it has since reached. In the year 1861 12,961 boats, manned by 42,751 fishermen and boys, were employed in the herring, and cod, and ling fisheries of Great Britain, and the boats, nets, and lines employed were of the estimated value of £783,037—an increase over the preceding year of £32,841, and of 321 in the number of fishermen.

Rain in England.—As a matter of fact, England, though a rainy country, is far surpassed by Norway and even by a part of Spain. Except in such an abnormal year as 1860, sunny weather during six months at least may be reasonably expected as the rule and not the exception. Yet the misty ideas of the Roman historian still float in people's minds. Even if dispossessed of the notion that England as a country is remarkable for rain and clouds, every one transfers the notion to his own county or to some other county where his summer holiday was once spoilt, so as to suit his particular grievance. Devon and Westmoreland are special victims to this, but Lincolnshire is the general scapegoat for atmospheric sins. It is but quite recently that railroads have informed people that its inhabitants are not web-footed, and do not keep boats instead of carriages. It is supposed to be the home of fogs, mists, and aguish miasmata. Only those who are deeply read can discriminate between the fens, wolds, and marsh into which it is physically divided, and the leaping-poles, still to be seen in a few districts, serve to keep in a state of credulous vitality the fabulous notions which have been mentioned. Yet, notwithstanding its evil odour, statistics disclose to us that Lincolnshire is among the driest counties of England.

Turbine Water Wheels.—The North Moor Foundry Company, we learn, are now executing orders for in all upwards of twenty of Schiele's patent turbine wheels. During the stay here of the Viceroy of Egypt's steam yacht it was fitted by the North Moor Foundry Company with one of Schiele's steam turbine ventilating machines, capable of delivering 1,200,000 cubic feet of air per hour, or 20,000 cubic feet per minute. The same makers have since received orders for a considerable number of these machines for Egyptian war ships, troop steamers, &c., for ventilation, clearing away smoke from the guns, &c.

British Association for the Advancement of Science.—The Thirty-second annual meeting of this Association commences on Wednesday, Oct. 1, 1862, under the presidency of the Rev. Robert Willis. The Town Hall will be open as a reception room, for the issue of tickets to members, associates, and ladies. The terms of admission are:—I. As life-members, a composition of £10, which entitles them to receive gratuitously the reports of the association which may be published after the date of payment. II. As annual subscribers, a payment of £2 for the first year. These receive gratuitously the reports for the year of their admission, and for every following year in which they continue to pay a subscription of £1, *without intermission.* III. As associates for this meeting only, a payment of £1. They are entitled to receive the report of the meeting at two thirds of the publication price. Ladies may become members on the same terms as gentlemen. Gentlemen who have in any former year been admitted members of the association may, on this occasion, renew their membership, without being called upon for arrears, on payment of £1. The general committee holds its first meeting in Town Hall, on the 1st October, for the election of sectional officers, and the despatch of business usually brought before that body. The general committee will meet again, in the same room, on the 6th October, at Three P.M for the purpose of deciding on the place of meeting in 1863. The concluding meeting of this committee will be held in the same room, on the 8th October, at One P.M., when the report of the committee of recommendations will be received. The general committee consists of the

following classes of members:—1. Presidents and officers of the association for the present and preceding years, with authors of reports in the transactions of the association. 2. Members who have communicated to a philosophical society any paper which has been printed in its transactions and which relates to such subjects as are taken into consideration at the sectional meetings of the association. 3. Office-bearers for the time being, or delegates, altogether not exceeding three in number, from any philosophical society publishing transactions. 4. Office-bearers for the time being, or delegates, altogether not exceeding three, from philosophical institutions established in the place of meeting, or in any place where the association has formerly met. 5. Foreigners and other individuals whose assistance is desired, and who are specially nominated in writing, for the meeting of the year, by the president and general secretaries. 6. The president, vice-presidents, and secretaries of sections, are *ex-officio* members of the general committee for the time being. The first general meeting will be held in the Town Hall, on October 1st, at Eight P.M., when William Fairbairn, Esq. LL.D., F.R.S., will resign the chair, and the Rev. Robert Willis, M.A., F.R.S., will assume the presidency, and deliver an address. The different sections will assemble in the rooms appointed for them, for the reading and discussion of reports and other communications daily until the 7th of October, at Eleven A.M. The committee of sections will meet in rooms adjacent to the section room, at Ten A.M. on the same days. There will also be several general and evening meetings. The sections are the following:—A.—Mathematical and physical science. *President.*—G. G. Stokes, Esq., M.A., F.R.S. B.—Chemical science. *President*:—W. H. Miller, Esq., M.A., F.R.S. C.—Geology. *President*:—J. B. Jukes, Esq., M.A., F.R.S. D—Zoology and botany, including physiology. *President*:—Thomas Huxley, Esq., F.R.S. (A subsection of physiology will be proposed in the general committee, Wednesday, Oct. 1st, under the presidency of Dr Paget.) E.—Geography and ethnology. F.—Economic science and statistics. *President*:—Edwin Chadwick, Esq. G.—Mechanical science. *President*:—William Fairbairn, Esq., LL.D., F.R.S. General and evening meetings:—On Thursday evening, Oct. 2, at Eight P.M., in the Town Hall, soiree. On Friday evening, Professor Willis's discourse. On Monday evening, Dr Odling's discourse. On Tuesday evening, soiree. John Phillips, assistant-general secretary.

Lights and Lighthouses.—Of all the works of general utility which have challenged the attention of mankind none possess higher claims to public gratitude than those whose objects are the safety and protection of men whose lot is cast on the waters. Among these lights and lighthouses must be considered of the most essential value; and those who have compared the lights and lighthouses of Britain such as they were half a century ago with those maintained under the present system can well appreciate the advances made by the adoption of the inventions and improvements suggested by science to secure powerful, steady, and continuous lights; and, if we mistake not, the day is near at hand when safe access to all coasts and harbours will be aided by lights far surpassing in effectiveness the combination of oil-fed lamps, mirrors, and lanterns, now in use. Between thirty and forty years ago Faraday made the beautiful discovery that a current of electricity could be obtained from a magnet, but it was not till 1855 that Mr Holmes commenced the construction of the machines which have brought Faraday's discovery into practical use. It was fortunate for Professor Holmes that while engaged in these experiments his pursuits came under the cognisance of Lady Howard de Walden, who perceived their importance, and who engaged heartily in carrying them out in spite of every difficulty, sparing no expense to accomplish the great object proposed. To her, therefore, belongs the honour of having brought the experiments of the philosopher to a successful issue. Possessing a large share of the talent and energy hereditary in the family of the Bentincks, she had not only acquired from her father, the late Duke of Portland, a strong interest in all naval matters, but for many years before Professor Holmes's experiments came under her notice, her attention had been turned to magneto-electricity, so that she was well prepared to adopt his proceedings and continue them under her own immediate auspices. They were principally carried on in Belgium, where Lord Howard de Walden has long been ambassador. Lady Howard was much encouraged in the prosecution of her plan by a highly favourable report made by Captain (now Admiral) Fitzroy, R.N., who visited Brussels in the spring of 1856, with a view of testing the qualities of the light, and its capabilities of being applied to the purposes of a lighthouse. Long and patient were the labours still bestowed on bringing the machinery to perfection, but it was not until 1857 that it was brought to London, and through the efforts of Captain Shepherd, then deputy master of the Trinity House, leave was given to try it at the South Foreland. No more eligible spot could be chosen for a comparative experiment. The magneto-electric light was here exhibited from Dec. 8, 1858, to the month of March, 1859, under the management of persons employed by Professor Holmes. It was then wished that, although its entire success had been clearly established as exhibiting a light far surpassing any other in brilliancy, and offering no difficulty in its manipulation, it should still undergo a further trial in the hands of the Trinity Board. This second trial, occupying about six months, was more satisfactory than the first. The Trinity Board then resolved on its removal to Dungeness, where, after some delays, it was displayed on the 6th June, 1862, and is still kept up with entire success. The strongest testimonials have been given by the commanders of the Dover, Ostend, and Calais packets to its brightness while at the South Foreland in thick misty weather, when the low light was completely obscured, and of the vividness with which it is now seen from Dungeness in mid-channel and 23 miles off. It may naturally be asked what is the comparative cost of maintaining the magneto-electric light; and the reply is highly satisfactory. Though the motive power of a small steam-engine, consuming 28lb. of coke per hour, is required for revolving the apparatus, the first cost of the plant is, on the whole, less than that of the apparatus of a first-class light-house; the consumption of carbon for one lamp costing only 2½d per hour In short, the first cost of the apparatus is less than under the present system, but the cost of maintainance is greater by about £100 a year, owing to the necessity of employing two men in working the steam-engine. But if life and property depend upon light-houses, surely there is no economy in risking annually hundreds of lives and millions of property to save the small additional expenditure just mentioned.

The Proposed Substitute for Cotton.—A meeting was held, Sept. 20, in the rooms of the Chamber of Commerce, Manchester, to examine and report upon the new fibre, which, first through Messrs Phillips, of London, was proposed as a substitute for cotton. The chair was taken by Mr H. Ashworth, the president of the Chamber. Mr Harben exhibited fibres on paper, a few threads only; small specimens in the grey state, as picked by hand, with a small specimen dyed; and dried specimens of the plant, exhibiting the natural and fibrous state. He stated, in confidence, the name of the plant which furnished the fibres exhibited, and then exhibited specimens of the plant in its natural state. He suggested that the unemployed should at once be occupied in collecting the material. In reply to an inquiry, Mr Harben said he had not gone into particular calculations of expense; nor had he made any experiments as to the mode of rendering the fibre available for cotton spinning machinery, his wish being that, on recommendation of the committee, chemists, spinners, and others might further investigate the properties, with a view to the public good.—Mr Harben then retired, when, after deliberation, the following resolution, moved by Mr Bazley, M.P., and seconded by Mr Malcolm Ross, was adopted:—Resolved, That the committee have heard with much interest the statement of Mr Harben, and have examined the samples and specimens of plants and fibres submitted. The committee not having been asked for any decision on the merits of this discovery, do not express any opinion in its favour or otherwise; and Mr Harben having expressed his wish, without reference to any pecuniary advantage to himself, that the discovery should be given to the world with a view to chemists, manufacturers, and machinists seeking out the best mode of making it available for the general interests of the trade, the committee acknowledge the disinterested conduct and candour with which Mr Harben has communicated his discovery, and views. The resolution having been read to Mr Harben, that gentleman, with a view to giving full effect to his intention, stated for the information of the public that his discovery is the applicability of the fibres of the marine plant known as *Zostera marina*, or common grass-wrack, to manufacturing or other purposes. This plant takes its name from the Greek word *zoster*, signifying a ribbon, from the shape of the leaves, which resemble a long narrow tape, and often reach the length of from three to four feet. The plant is not a sea-weed, yet it resembles sea-weeds, and lives among them. To botanists the *zoster* is interesting from the exceptional character of its flowers, and from its mode of reproduction, which is totally different from all that is known of other flowering plants, and the manner in which fertilisation takes place among those plants is unknown. The home of the *zostera* is the bottom of the ocean, and it is found from the North Sea to the Mediterranean, in the Indian Ocean, and on the Arabian coasts. The *zostera marina*, or sea-wrack, is a British species, and is used as a common material for packing, and for stuffing cottagers' cushions and beds. It has also been used medicinally as a poultice for tumours, not, however, for its own sake, but chiefly for the iodine of the seaweeds that are gathered with it. Botanists have differed in their judgment as to the order to which the plant belongs. Paxton places it among the *Fluviales*. Lindley reckons it as forming an order of itself, which he calls *Zosteracea*. In the botanical department of the Museum at Kew, it is exhibited as a member of the Lily Order (*Liliacea*), and its bulbous root favours this arrangement. The grass-wrack is therefore shelved at Kew in close neighbourhood (as a member of the same family) with the bowstring hemp—fibre well adapted for cordage, obtained from the leaves of an Indian plant; with New Zealand flax; and with those branches of the palm family from whose leaves Panama hats are made. The hand-book to the Museum of Economic Botany at Kew says of the grass-wrack, that, "it is common on the British coasts, and in most parts of the world, near low water mark." It is also common in salt water ditches, and flowers in August and September. The production of fibre from the *zostera marina* is no novelty. It has often been included in patents for paper making, and for other useful purposes. At the same time, there is reason for great doubt whether any fibre can be made from it fit for manufacturers to use. Supposing, however, that this difficulty were overcome, it is a question whether the plant can be found in sufficient quantities on the coast of Great Britain to make it worth collecting.—

German Silver and Electrotpying.—The composition of white metal varies considerably, nearly every manufacturer having some scheme of his own for producing it; but in most cases the difference is simply a difference in the proportions of the metals used, the use of copper, zinc, and nickel being deemed indispensable by all. One will employ 16 lbs. copper, 8 lbs. zinc, and 3½ lbs. nickel; another 8 lbs. copper, 3½ lbs. zinc, and 2 lbs. nickel; whilst a third uses 28 lbs. copper, 13 lbs. zinc, and 7½ lbs. nickel. We have seen nothing to surpass the alloy formed of 8 lbs. copper, 3½ lbs. zinc, and 3 lbs. nickel. When carefully prepared, this requires an excellent judge to distinguish it from silver itself. As to nickel, it may, when pure, readily be mistaken for silver, the sole difference being that the nickel is more inclined to grey. Nickel, as it usually comes into the market, is chiefly obtained from nickeliferous pyrites, and from a product obtained in treating cobalt, which is a somewhat similar metal. In this state, however, it would be altogether unfit for

the manufacture of German silver. To obtain the pure metal the powdered cobalt speiss—for so the product alluded to is named—is roasted first alone and then with charcoal, to get rid of the arsenic which is always mixed with it. What remains is mixed with three parts sulphur and one part carbonate of potash, and the whole then fused in a large earthen crucible. The product is next purified with warm water, by which the arsenic and sulphur combined with the potash are dissolved, and sulphide of nickel—that is, sulphur and nickel mixed in equal proportions—remains at the bottom of the vessel which has been used. When all the arsenic has been removed, the sulphide is again washed in warm water and treated with certain acids: it is ultimately made ready for use. But great as has been the perfection arrived at in the manufacture of white metal, the discovery of the very beautiful processes connected with electro-metallurgy has enabled it to be to some extent superseded, since by this means articles can be produced which it is impossible even for the most experienced eye to distinguish from solid silver. Indeed, nothing but pure silver is presented to the view, every portion of the inferior metal being covered with a film of the more valuable material. Our readers are, no doubt, aware that electricity is very easily and continuously produced by the combined action of two metals and an acid: if two plates, the one of zinc and the other of copper, be connected together by a piece of wire, and the plates are then partly immersed in acid water, there will be a continuous current of electricity from the zinc plate through the liquid to the copper, and from the copper plate through the wire to the zinc; and however complicated the battery may be, this simple circuit alone takes place. If the wire be broken, or if the current through the acid be stopped, the flow of electricity ceases. From what has been said it will be understood that the electricity leaves the battery at the top of the copper plate, passes through the wire, and re-enters at the top of the zinc plate; and, technically, the end at which the electricity leaves is called the *positive*, and that at which it re-enters the *negative* end. But this wire between the positive and negative ends of the battery may be cut in two, and any substance capable of letting a stream of electricity pass through it inserted, when the flow will go on as before. Suppose, for instance, the wire was cut, and a metal tea-pot hung to the two ends, one end being attached to the handle and another to the spout; the electricity would pass through the liquid from the zinc to the copper, and through the wire and tea-pot from the copper to the zinc. The tea-pot would be placed just in this position if it were wished to electro-plate it, but instead of the connection being made precisely as described, something else is inserted between the wire from the copper end and the tea-pot—this is a solution of silver—and the electricity passes through this silver solution as easily as through solid metal; and not only so, but it takes up the silver and deposits it on the tea-pot. In practice the tea-pot would be placed in the silver solution, and the electricity would then deposit the silver equally on every side, after which it would be carefully finished for sale. As to the fashioning of the various articles, the process varies according to the form to be imparted. Sometimes the hammers and chisels alone are brought into requisition; at others the several segments are stamped by dies and soldered together to get the desired form. Next comes the chasing or engraving, which is effected by means of neat little hammers and needle-like chisels. Assuming it to be a tea-pot to be operated upon, it is first filled with a compound of hot pitch and chalk, which, upon cooling, becomes so hard and tough that the chisel can be used freely, without making the sides bend. After the chaser has done his work the tea-pot is passed to the polisher, who carefully polishes it, and then passes it on to the "electro-room," in which it is submitted to a process, based upon principles above described. The wire from the negative end of the battery passes into a trough, containing a solution of silver, where it is attached to the teapot and the other wire, which also passes into the same trough, is connected to a plate of silver, the object of which is to supply the solution with fresh silver as it becomes exhausted by the deposition on the tea-pot. By this arrangement the strength of the solution is kept up for years. The electricity, whilst upon its passage decomposes one atom of the cyanide of silver in the trough, and forms another similar atom to make up for the decomposition. The action of the solution of cyanide of potassium in the bath combined with that of the electricity, causes the metallic silver to combine with the cyanogen, and thus the strength of the solution is maintained. It should have been stated that the fluid in the trough is rather a complicated chemical substance, being a compound salt of cyanide of potassium and cyanide of silver, or a solution of cyanide of silver in cyanide of potassium. A solution of a pure cyanide of silver might be substituted for the double cyanide above alluded to, but as it would then be far more troublesome it is seldom used. As electricity always takes the shortest road it can find, the salts of silver in the solution would not be equally deposited if they were permitted to remain motionless; so, to ensure a regular deposit a simple piece of clock-work causes a brass frame to move up and down the trough and keep the liquid constantly stirred. Before the tea-pot is put into the trough it is brushed with a soft brush and fine sand, then dipped in caustic potash, next in aquafortis, and then washed in nitrate of mercury until it looks milky. It is then put into the trough and after a few minutes is taken out, brushed and put back again, being then left for five, six, or seven hours, by which time a sufficiently thick layer of silver will have been deposited. When it is taken out it is well brushed with stale beer, and is then ready to be burnished. The burnishing department engages women only—the tools are of various shapes, and are made of fine steel or agate, according to the part of the operation for which they are intended. These burnishers are well and carefully rubbed over every part of the pot that is to have a polished appearance, for it should have been said that when the article leaves the electro-trough it is anything but brilliant in appearance, every portion of it resembling far more closely that which is generally known as frosted silver. The burnishers are kept in order by repolishing them from time to time upon a leather strap, with soap suds made very thick. The burnishing being completed, the pot will be ready to pack for sale.—*The Ironmonger.*

Messes Huxly & Company's Tobacco Manufactory, Whitechapel-road, London.—The premises, which have been recently re-built, are in the Whitechapel-road, and cover a vast area, extending to a depth of 250 feet. Our attention is called, in the first place, to numerous large hogsheads and bales then unloading at the wide entrance-gate of the warehouse; the duty on every one of the hogsheads, which weigh about 15 cwt. each, amounts to £250, and must be paid to Her Majesty's Commissioners of Customs before a single leaf of the contents can be touched by the manufacturer. The first compartment of the leaf-room, contains a great variety of leaf. We have here hogsheads from Kentucky, Virginia, Maryland, Ohio, &c. As it would prove rather a tedious operation to unpack the leaves from them, a more expeditious process is resorted to, consisting simply in sawing the casks asunder longitudinally, and removing the two halves from the tobacco packed up inside. Besides the hogsheads, we have bales from Brazil, and other parts of South America, Cuba, Java, &c., varying in weight from 1 to 5 cwt. The leaves unpacked from the hogsheads and bales are then taken, first, to another part of the premises, where they are *stalked*, or stripped of their middle ribs by the hands of boys. The leaves turn out occasionally too dry to admit of the easy removal of the middle rib; they are in such cases exposed, for a few minutes, to the action of steam in a steam closet near at hand, to make them sufficiently supple for the operation. The split leaves are now carried back to the leaf-room, where the several sorts are mixed together, in certain definite proportions by weight, to produce the different kinds and qualities of cut tobacco which it is intended to manufacture. This branch of the business requires the most consummate knowledge of the produce of the several countries from which the supplies are drawn, as well as a thorough knowledge and subtle appreciation of the tastes of the different classes of consumers,—a knowledge which can be acquired only by many years' practice. Each set of mixed leaves is, after its removal from the weighing-scale, spread out, separately, on the floor of the compartment, where the leaves are then sprinkled with pure water. The object of this operation is simply to moisten the leaves, which generally arrive at the warehouse in a state of great dryness, and to make them sufficiently supple for the subsequent process of pressing. The heaps, which, of course, are carefully kept asunder, are turned over repeatedly to ensure an equable distribution of the moisture. After twenty-four hours, they are pressed or squeezed into square cakes, technically called *boxes*, two feet square by four inches thick, and weighing about 25 lbs. each. These cakes are then transferred to the cutting machine, or cutter, where they are placed on a smooth bed within a horizontal trough, and pressed down tight by a follower and screws, to keep them quite compact, so that they may oppose a firm resistance to the knife, ensuring thus a clean cut. The cakes are progressively advanced upon the bed to meet the cutting blades, the degree of fineness of cut being regulated by the size of the ratchets of the wheel. The edges of the cutting blades are made of the best tempered steel. The cutting machines are worked by steam power; there are three of them constantly at work here, cutting up about 5000 lbs. of tobacco a-day. The cut tobacco is taken to another compartment, where we see a kind of long table with four horizontal troughs or pans let into the top. The first and third of these troughs have a canvas bottom stretched over a perforated copper plate; these are called *steam pans*. The tobacco is first thrown into the second trough, which lies between the two steam pans, and serves as a receptacle, from which the pans are fed; it is then transferred to the pans on both sides, and the steam being turned on from below is made to pass through it for about two minutes. This operation is simply intended to separate the fibres of the cut tobacco, which, from the great pressure brought to bear upon the cake in the squeezer and in the cutting machine, stick close together in a tangled mass. This object accomplished, the loosened tobacco is transferred to the fourth trough, which is technically termed the *fire pan*; on the smooth sheet-iron bottom of this, which is also heated from below, the steam is dried out again; this operation also occupies about two minutes. The hot tobacco is then carried, in wooden trays, to the *rack*, where it is spread in layers about two inches thick, and left to cool. When the article is quite cold, it is folded up into what the workmen in the factory technically call *cobs*. These cobs present the shape of large round loaves; they weigh about eight pounds each. A cob of each different sort of tobacco prepared in the course of the day is taken to the sample room, to undergo proper inspection next morning. A portion of the finished article is now taken to the packing-room, where it is packed in casks or boxes, ready for dispatch. The other portion is taken to the first floor. Here we enter a spacious, well-lighted gallery, with a table running from end to end on both sides. This is the moulding-room, constructed expressly by the firm to meet the demand of the dealers in tobacco, who find it advantageous to receive the article in the quantities in which they usually sell it, viz., 1 ounce, 2 ounce, and ¼ lb. packets. The operation of packing is performed here by a number of young girls between 12 and 14 years of age, under the superintendence of a forewoman. These girls are divided into parties of three,—one to weigh the tobacco, the other two to mould the packets. The packages are round; they are made with paper, by means of wooden moulds and tinplate funnels. The nimble fingers of the children perform this operation with astonishing facility and

rapidity; as fast as the one of the set can weigh, the other two complete the packets, and the weighers seem to have acquired such expertness in their branch of the performance that the balance almost invariably stands at the first try. To make the wooden moulds more durable, they are furnished with brass tops; and to prevent the tables splitting by the constant knocking and friction inseparable from the operation carried on on them, the front of them is made of teak. The smaller packages are made up by the forewoman into 1 lb. packets, which are then sealed over small gas-burners, connected with the pipe by flexible india-rubber tubes. A lift opening into the gallery serves to convey the various articles from the ground floor to the first floor, and *vice versa*. At the end of the gallery there is a spacious room filled with an infinite number of chests of various sizes. This is the cigar warehouse, and these chests contain every sort and variety of cigars, from the lordly Cabana and the magnificent regalia down to the humble cheroot and the penny Pickwick. The stalks, or middle ribs removed from the leaves, undergo a first process of comminution in a cutting-machine on the ground-floor of the premises, which is worked by steam power. The cut pieces are then sent away to be ground in mills, mostly worked by water power; the powder or snuff is brought back to the factory in large hogsheads, to undergo the final operations and manipulations to fit the article for sale and consumption. Part of the grinding is, however, done on the premises on the first floor, in a grinding mill worked by steam. The manufacture of rolled tobacco is carried on in a separate warehouse. The Virginia leaf alone is used for making the different sorts of pigtail, bogie, Alloa, and Cavendish. The leaves intended for the purpose are first sprinkled with water to make them quite soft; they are then stripped of their middle ribs, and those intended for the thinner sorts cut across the middle into two halves. They are now wound or spun into ropes of different sizes, with the aid of a so-called spinning mill with fly-wheel, the operation somewhat resembling the twisting of twine and rope on a rope-walk. A boy acts as feeder, handing the leaves to a man who rolls them on a table, by means of a flat-iron strapped to the hand; this instrument is technically called a *hand-board*. The ropes are wound into barrel-shaped rolls of 1, 2, or 3 lbs. weight. The large sized ropes are also first made into rolls, which are then squeezed quite flat in a press; the flattened cakes constitute the Cavendish of the shops. The barrel-shaped rolls of pigtail, &c., are subjected for some time to a high pressure, which makes them ultimately turn black, the natural juice of the tobacco getting squeezed through the whole mass. Lastly, in the rear of the premises we are shown a steam engine of ten horse power, with boiler-house adjoining. This engine supplies all the steam power required in the several departments of the establishment.—*The Grocer*.

Decimal System of Weights and Measures.—The select committee of the House of Commons has lately issued its report, containing the following recommendations. 1. That the use of the metric system be rendered legal. No compulsory measures should be resorted to until they are sanctioned by the general conviction of the public. 2. That a Department of Weights and Measures be established in connection with the Board of Trade. It would thus become subordinate to the Government, and responsible to Parliament. To it should intrusted the conservation and verification of the standards, the superintendence of inspectors, and the general duties incident to such a department. It should also take such measures as may from time to time promote the use and extend the knowledge of the metric system in the departments of Government and among the people. 3. That the Government should sanction the use of the metric system (together with our present one) in the levying of the Customs' duties; thus familiarizing it among our merchants and manufacturers, and giving facilities to foreign traders in their dealings with this country. Its use, combined with that of our own system, in Government contracts has also been suggested. 4. That the metric system should form one of the subjects of examination in the competitive examinations of the Civil Service. 5. That the *gramme* should be used as a weight for foreign letters and books in the Post-office. 6. That the Committee of Council on Education should require the metric system to be taught, as might be easily done by means of tables and diagrams, in all schools receiving grants of public money. 7. That in the public statistics of the country quantities should be expressed in terms of the metric system in juxtaposition with those of our own, as suggested by the International Statistical Congress. 8. That in private Bills before Parliament the use of the metric system should be allowed. 9. That the only weights and measures in use should be the metric and imperial, until the metric has been generally adopted. 10. That the proviso in the 5th and 6th William IV., cap. 63, clause 6, allowing the use of "local and customary measures" in cases where the vessel employed "is not represented as containing any amount of imperial measure or of any fixed local or customary measure heretofore in use," should be repealed as giving facilities to evade the statute. 11. That the department which it is proposed to appoint should make an annual report to Parliament.

REPORT OF THE COMMISSIONERS OF PATENTS.

The commissioners have lately issued their annual report, from which we learn that the number of applications for provisional protection received in the year 1861 was 3,276; the number of patents passed thereon was 2,047; the number of specifications filed in pursuance thereof was 2,015; the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months of provisional protection, was 1,129.

Four thousand patents bears date between the 1st Oct., 1852 and the 17th June, 1854 (being the first 4,000 passed under the provisions of the Patent Law Amendment Act, 1852.) The additional progressive stamp duty of £50 was paid, at the end of the third year, on 1,186 of that number, and 2,814 became void. The additional progressive stamp duty of £100 was paid at the end of the seventh year on 690 of the 1,183 patents remaining in force at the end of the third year, and 796 became void. Consequently nearly 70 per cent. of the 4,000 patents became void at the end of the third year, and nearly 90 per cent. became void at the end of the seventh year. The number of patents sealed in 1854 was 1,876; the progressive duty of £50 due in 1858 was paid upon 558 of this number; and the progressive duty of £100 due in 1861 was paid upon 142 only; therefore the proportionate number of patents becoming void by reason of non-payment is increasing.

All the provisional, complete and final specifications, filed in the office upon the patents granted under the Act since 1852, have been printed and published in continuation, with lithographic outline copies of the drawings accompanying the same, according to the provisions of the Act 16 and 17 Vict., c. 115.

The provisional specifications filed in the office and lapsed and forfeited have also been printed and published in continuation.

The work of printing the specifications of patents under the old law, 13,561 in number, and dating from 1711 to 1852, was completed in 1858, and copies thereof are sold in the office at the cost of printing and paper.

Abstracts or abridgments of specifications, in classes and chronologically arranged, of all patents, from the earliest enrolled up to the present time, are in course of preparation and publication.

Annexed to the report is a schedule giving an account of the stamp duties received, and a balance sheet of their receipts and expenses.

An Account of Stamp Duties received under the Act to substitute stamp duties for fees (16 Vic., c. 5.) for the year 1861.

	£.	s.	d.
3,276 petitions for grant of letters patent at £5 each	16,380	0	0
2,273 notices of intention to proceed with application, at £5 each	11,369	0	0
30 notices of objection to the grant of letters patent, at £2 each	60	0	0
2,049 warrants for patents at £5 each	10,245	0	0
2,047 patents sealed, at £5 each	10,235	0	0
1,976 final specifications filed at £5 each	9,835	0	0
48 complete specifications filed at £5 each	240	0	0
577 entries of assignments of patents and licenses, at 5s each	144	5	0
755 searches and inspections, at 1s each	37	15	0
11,040 folios of office copies of documents, at 2d per folio	92	0	0
540 patents upon which the progressive stamp duty of £50 has been paid	27,000	0	0
142 patents upon which the progressive stamp duty of £100 has been paid	14,200	0	0
6 duplicate patents issued in lieu of original patents lost or destroyed, £5 each	30	0	0
14 petitions on application for disclaimers, at £5 each	70	0	0
10 caveats against disclaimers at £2 each	20	0	0
5 new patents granted upon Her Majesty's Order in Council, under the 40th section of the Act (1852), being prolongations of patents granted previous to the Act, at £5 each	25	0	0
	£99,979	0	0

Balance Sheet of Income and Expenditure for the Year 1861.

Receipts.

	£.	s.	d.
Stamp duties in lieu of fees	99,979	0	0
By sale of prints of specifications, indexes, &c.	2,051	0	0
	£102,030	17	0

Payments.

	£.	s.	d.
Fees to the law officers of England	8,965	19	0
Their clerks	814	5	0
Salaries of the officers and clerks in the Patent Office	6,573	0	0
Compensations	4,584	0	0
Current and incidental expenses in the Patent Office	4,153	18	1
Cost of stationery supplied by Her Majesty's Stationery Office, books for the free library, and binding, &c,	2,594	10	7
Rent of offices, rates and taxes	617	0	0
Messrs Eyre and Spottiswoode for printing Specifications of Patents, indexes, &c., lithographers bills for drawings accompanying specifications	13,425	14	0
Cost of paper supplied to the printer and lithographer by Her Majesty's Stationery Office	2,786	13	2
Cost of coals and other fuel supplied to the Patent Office by Her Majesty's Office of Works, and furniture and repairs	131	19	10
Expenses incurred in respect of the Museum at South Kensington	1,190	13	7
Salaries of officers and clerks for ditto	730	0	0
* *Revenue* Stamp duty account	18,485	0	0
† *Surplus Income* for the year 1861	36,978	3	9
	£102,030	17	0

Leith Graving Docks.—The new graving dock at Leith is nearly completed, and will soon be opened. These works have occupied some four or five years in construction. Mr Rendel, the Government engineer, prepared the plans, and Mr Alexander Wilson was the contractor. The outer bulwark is upwards of 1,200 feet long, 20 feet high, and 20 feet broad at the base. This part of the work has been already tested by the numerous gales that have raged in the Firth since its completion. It was found not to be sufficiently high to prevent the waves washing over it, and therefore a close

wooden fenee was put up on the top, which has proved effectual in preventing the water washing over into the dock. After the bulwark had been finished, the excavation was commenced. The foundation-stoue of the building at the dock-gate was laid 13 feet below the low-water mark, and at this part of the doek there are 8 feet of building below the dock sill. Inside of the entrance, and to the whole extent of the doek, there is a bottom 5 feet 9 inches thiek of mason work first, 3 feet 9 inches thick of brick work, and 2 feet thiek of stone. The side walls of the entranco are of a very substantial deseription, and are fine specimens of workmanship. The side walls of the inner portion of the doek are equally strong, and are stepped at the sides and east end. Conduits are formed for the running off of the water to low-water mark. The dock is 400 feet in length. There are no flood-gates, hut there is an iron caisson, whieh has been huilt by Messrs S. & H. Morton, engineers and shiphuilders, Leith. The caisson resembles an iron-huilt vessel of extremely narrow dimensions, and lies across the entranee, tightly fitting into a groove, so as to prevent water flowing out or in when it is sunk into its proper plaee. It will float out and into the groove when necessary, water heing put into it when necessary to fix it, and the water pumped out of it when required to float it out. On the top or deck of the eaisson there is a roadway, 12 feet broad, proteeted on each side by iron railings, over whieh those going down the east pier will in future have to pass. One of William Simpson & Company's (of London) patent engines and pumps has been fitted up in a fire-proof building on the north-east side of the dock, for pumping the wator out of tho dock. There will be about 5 feet deep of water to pump out of the dock at stream tides, and about 10 feet at neap tides. There are short wing-walls, extending outward from the outside of the eaisson, and from these to the harbour piles are being driven and lined with plank as an enclosure, in place of quay walls. The entrance to the dock at the harbour will be about 400 feet broad, and to this extent the east pior is being takeu down. The north sido of entrance at tho pier will be ahout 60 feet from the upper lighthouse. Betwixt the eaisson and the east pier, the entranco has been excavated 2· feet below the dock sill, and the portion of the pier necessary to be removed will soon be demolished, after which tho dredging engine will bo called into requisitiou to elear away the clay to tho necessary depth under tho pier. The blocks on which the vessels will rest in the graving dock have been placed, and aro ready for use. Between the harbour and the entrance to the dock there is a good deal of work to finish, and the ground round the dock has to be levelled down and paved or macadamised. Tho works have heen earried on under the superintendence of Mr G. Rohertson, resident engineer, inspeetor of works. When all the works in eonnection with the dock are finished, it is believed the expense will amount to £100,000.

The South-Eastern Railway have recently added another steamer to their fleet, the *Albert Edward*. Her trial Irip took place on the 26th of July, when she attained an average speed of 16 7 knots per hour, and she is now employed on the service between Folkestone and Boulogne, in connection with the special daily tidal trains. She performed the passage between those two ports for the first time on Tuesday, when, with a strong south-west wind blowing and 330 passengers, the distance of 26 miles was accomplished in 93 minnles. The *Albert Edward* and her sister ship, the *Victoria*, also the property of the South-Eastern Railway Company, are asserted to be the fastest vessels afloat.

Iron Shipbuilding on the Tyne.—Though the agitated condition of the Russian Empire has cheeked the demand on the Tyne for iron steam vessels for river purposes in North Europe and the South of Europe, iron shipbuilding is the most thriving trade upon that wonderfully productive river at the present time, and will be, it is likely, for many months to come. The large firm of Messrs Palmer, Brothers, of Jarrow, have quite recovered the rude shock consequent on the mishap with the Galway contract, and at present they have on hand no less than 16 iron steam vessels of from 3000 to 1000 tons each, and have orders which will keep their yards going at full time two years. Those vessels are for London, French, and Italian owners principally; but there are good orders on the Tyne for Spanish and South American owners, and all the other yards upon the river, besides Messrs Palmer's, are likely to be well employed during the incoming months. Iron shipbuilding is also doing well upon the Wear and at Hartlepool and the Tees, and shipbuilding generally is considerahly improving upon the north country rivers. The rolling mills at Consett are also kept pretty husy executing orders for iron plates for the *Achilles*, building by the Government.

A New Propelling Power.—On the Seholdt, near Antwerp, experiments have been made with a river-boat, provided with a new propelling power whieh has been reeently discovered. The boat has neither paddle-wheels nor screw. In the middle of it, however, is a eone-shaped vessel into which the water is pumped up, and from which it is driven out with great foree into the river through two curved boxes on the side of the hoat. hy whieh means the vessel is propelled forward with great swiftness. By simple machinery the arrangements of the boxes ean be so altered that the boat ean be turned immediately and steered in any direetion. The experiments made with this boat, which is intended to ply between Luik and Seraing, have far exceeded expectation, and will perhaps cause a revolution in the means of propulsion. The new system which has been discovered hy a Germ-n, one Mr Seiber, ean be very well applied to large vessels.—*Dutch Paper*. [This is a modification of Mr Ruthven's system of propelling, whieh was patented in this country some years ago.]

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY

FOR THE MONTH ENDING SEPTEMBER 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	d	£	s	d	£	s.	d.	£	s.	d.
Bars, &c., British, per ton,	6	10	0	6	10	0	6	15	0	7	10	0
Nail Rods,	7	0	0	7	0	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	5	0
Sheets,	8	10	0	8	10	0	9	0	0	9	10	0
Pig, No 1, Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	0	0	7	0	0	7	0	0
Rails,	5	7	6	5	10	0	5	0	0	5	0	0
Pig, No 1, Clyde,	2	11	9	2	12	0	2	16	0	2	15	9
Swedish in bond,	10	5	0	11	10	0	11	0	0	11	0	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	10	0
In faggots,	15	10	0	15	10	0	15	10	0	15	10	0
Spelter, ingot,	17	15	0	10	17	0	17	15	0	18	17	6
Zinc, sheet,	23	10	0	23	15	0	24	10	0	24	10	0
COPPER,												
Sheathing bolts, pr lb,	0	0	11	0	0	10¼	0	0	10¼	0	0	10¼
Bottoms,	0	0	10¾	0	0	11	0	0	11½	0	0	10½
Old,	0	0	9	0	0	9	0	0	9	0	0	8¾
Tough Cake, per ton,	91	0	0	92	0	0	92	0	0	92	0	0
Tile,	93	10	0	92	0	0	92	0	0	93	0	0
TIN.												
English blocks, per ton, duty free,	111	0	0	111	0	0	112	0	0	112	0	0
Bars in barrels,	112	0	0	112	0	0	113	0	0	112	0	0
Refined,	116	0	0	116	0	0	117	0	0	116	0	0
Banca, in bond,	115	0	0	115	0	0	116	0	0	115	0	0
Straits, ditto,	114	0	0	113	0	0	113	0	0	114	0	0
TIN PLATES.												
Char IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	2	6	1	2	6	1	2	6
LEAD.												
English pig,	20	0	0	21	0	0	21	5	0	20	10	0
Sheet,	21	0	0	21	10	0	20	10	0	21	5	0
Spanish pig, in bond,	19	10	0	19	0	0	19	5	0	19	10	0
TIMBER—per load.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	4	0	0	4	0	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	10	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	0	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	0	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	43	0	0	43	0	0	45	0	0	47	0	0
" yellow,	43	0	0	45	0	0	45	0	0	45	0	0
Sperm,	84	0	0	85	0	0	86	0	0	85	0	0
Cod,	39	10	0	41	0	0	41	0	0	41	10	0
South Sea,	38	0	0	38	0	0	39	0	0	38	10	0
Olive, Gallipoli, per tun,	57	10	0	58	0	0	59	6	0	60	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	51	10	0	51	10	0	52	0	0	52	10	0
Rape pale foreign,	52	0	0	52	0	0	52	0	0	53	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	33	0	0	34	0	0	35	0	0
Jute,	16	0	0	16	10	0	23	0	0	23	15	0
Hemp Rope,	23	0	0	24	0	0	24	0	0	24	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

4th August, 1862.

2194. A. & E. M. Denuy, Waterford, Ireland—Manufacture of bacon.

5th August, 1862.

2195. Siegfried Simon, Tuilerie Street—Ornamenting slippers.
2196. Joseph Thomas, Poland Street—Self-adjusting screw wrench.
2197. James Higgin, Manchester—Material for printing and dyeing.
2198. Joseph Townsend, Glasgow—Damping Cotton, and preserving size.
2199. William Clark, Chancery Lane—Purification of water.—A com.
2200. M. J. Roberts, Pendarren House, Brecon—Spinning and preparing wool.
2201. J. R. Nicholl, Streatham, Surrey—Utilizing sewage.
2202. Abraham Priestly, Huddersfield—Distributing sand upon rails to give adhesion to brake wheels.

6th August, 1862.

2203. W. W. Burdon, Newcastle-upon-Tyne—Reducing wood fibres to pulp.
2204. J. C. Richardson, Lichfield—Cleaning cotton waste.
2205. M. C. Siuibaldi, South Street, Greenwich—Manufacture of chains.
2206. W. G. Valentin, Oxford Street, and Frederick Levick, Blaina—Generation of combustible gases.
2207. Ferdinand Nauheim, Cecil Street—Ornamenting boots.
2208. J. H Johnson, Middlesex and Glasgow—Armour plates.—A com.

7th August, 1862.

2209. M. A. F. Mennons, Paris—Self-inking hand stamp.—A com.
2210. Charles Culling, Downham Market—Fire-arms.
2211. Alfred Thiriez, France—Glazing thready fabrics.
2212. Chevalier de Fenis de Lacombe, Paris—Lighting and ventilating.
2213. J. H. Johnson, Middlesex and Glasgow—Blast furnaces.—A com.
2214. R. A. Brooman, Fleet Street—Ships and vessels.—A com.
2215. R. A. Brooman, Fleet Street—Ships and vessels.—A com
2216. William Clark, Chancery Lane—Spars and sails of vessels.—A com.
2217. Benjamin Coombe, Mark Lane—Cleaning grain.
2218. R. W. Ralph, Honnington Grange, near Newport—Reaping machines.

8th August, 1862.

2219. Edward Hall, Batts Green, Yorkshire—Preparing foreign grain.
2220. Jean Siron, France—Cure for distempers.
2221. F. M. Jennings, Cork—Coating ships' bottoms.
2222 John Whipp, Rochdale—Cleaning jewelry.
2223. N J. Amies, Manchester—Bearings, "journals," and "steps."
2224 R. A. Brooman, Fleet Street—Fire-arms.—A com.
2225. William Clark, Chancery Lane—Signalling.—A com.
2226. Edward Humphreys, Deptford—Steam engines.
2227. John Tatham, Rochdale—Spinning and weaving

9th August, 1862.

2228. John Macintosh, North Bank—Motive power.
2229. Robert Fowler, Glasgow—Woven, plaited, and other fabris.
2230. George Haseltine, Fleet Street—Carriage wheels.—A com.
2231. Sir J S. Lillie, Pall Mall—Carriage ways and footways.
2232 J. J. H. Gebhardt, Lawrence Lane—Fastening for purses —A com.
2233. A. J. Moreau and A. E. Ragon, Bernard Street—Bituminous substances.
2234. A. J. Moreau and A. E. Ragon, Bernard Street—Gas and coke.
2235. T. De la Rue, Westbourne Terrace—Pigments and writing inks.
2236. G. T. Bousfield, Brixton—Hat bodies.—A com.

11th August, 1862.

2237. H. B. Barlow, Manchester—Weaving, warping, sizing, and dressing.—A com.
2238. Hugh Fenton, Queen's Ferry, and W. Stubbs, Liverpool—Telegraph wires.
2239. W. E. Newton, Chancery Lane—Compressing powder for cartridges.—A com.
2240. Jacob Goodfellow, Blackburn—Engines.
2241. Tom Holdsworth and John Crossley, Halifax—Warping, scouring, and beaming yarns.
2242. William Clark, Chancery Lane—Carriage for sugar moulds.—A com.
2243. N. J. Aimes, Manchester—Bearings or steps in machinery.
2244. James Lancelott, Birmingham—Ornamental chains.
2245. M. H. Champion, Paris—Self-closing buttons.
2246. W. E. Gedge, Wellington Street—Ladders.—A com.
2247. John Combe and J. H. Smallpage, Leeds—Winding cops.
2248 Hugh Donald, Johnstone—Shearing, punching, and riveting metals.
2249. A. J. Martin, High Street, James Goss, Bow Road, and John Bush, Bow Common—Distillation
2250. Roger Gresty, Packington Street—Scarfs or cravats.

12th August, 1862.

2251. William Macnab, Greenock—Steam boilers
2252. John Ramsbottom and George Hacking, Accrington—Flow of fluids.
2253. James Dickson, Tollington Road—Treating zinc ores.
2254. James Dickson, Tollington Road—Treating ores.
2255. Louis Serbat, South Street—Lubricating machinery.
2256. C. A Wheeler, Swindon—Perforating paper.
2257. Alexander Delrue, France—Incrustation in boilers.
2258. C. M. Westmacott, Noble Street—Cements.
2259. James Langran, Kimbolton—Driving agricultural machinery.
2260. J. F. J Leblond, Paris—Sewing machines.
2261. A. B. Childs, Oxford Street—Cutting veneers.—A com.
2262. Charles Sengry, Great Queen Street—Smoking pipe.
2263. George Sanders, Old Kent Road—Domestic fire escapes.
2264. John Bower, Carlow—Railway sleepers.

13th August, 1862.

2265. James Dickson, Tollington Road—Chlorine.
2266. James Dickson, Tollington Road—Sodium.
2267. John Cooper, Town Malling—Valves and buckets for pumps.
2268. John Smith, Regent Street, and J. S. Rayment, Rayment Road—Generating steam.
2269. J. R. and F. C. Tassuad, Marylebone Road—Compositions of wax.
2270. C. W. Smith and William Mould, Belmont, and Samuel Cook and W. H. Hacking, Bury—Looms for weaving.
2271. W. L. Boyle, Eastbourne Terrace—Chairs, couches, and beds.
2272. Joseph Peters, Rochester—Hydraulic cement.
2273. Harper Twelvetrees, Bromley—Rat and mice traps.
2274. George Turner, Woolwich Dockyard—Fastening armour plates of ships.
2275. L. D. Verstraet and E M. Olivier, Paris—Carbonate of soda.
2276. Leonardo Galli, Tuscany—Propelling vessels.
2277. William Schnell, Charlotte Street—Sulphurous acid.
2278. J. H. Johnson, Middlesex and Glasgow—Carts and other vehicles.—A com.

14th August, 1862.

2279. E. J. Dagnall, Wandsworth—An improved tray.
2280. A. Walker, Liverpool—Ascertaining depth of water and distance of ships.
2281. John Irvine, Patshill, and J. W. Hand, Beckbury—Rifle rest.
2282. John Key and Ebenezer Hoskins, Birmingham—Metallic pillars for bedsteads, &c.
2283. George Welch, Birmingham—Inkstands, penholders, &c.
2284. C. E. Wilson, Monkwell Street—Buckle for braces and belts.
2285. William Beatson, Rotherham—Stoves.
2286. George White, Torquay, Francis Buckland, Newton Abbott, and Charles Rees, Newton Bushel—Water closets.
2287. D. P. Marques, Barcelona, Spain—Cleaning bottoms of vessels.—A com.
2288. H. R. Passey and Louis Niman, Little Newport Street—Cigar tube.
2289. John Petrie, Rochdale—Blowing and exhausting air.
2290. W. J. Curtis, Tufnell Park Road—Fares of public vehicles.
2291. James Hopwood, Ashton-under-Lyne—Collecting fibrous material.
2292. James Hearn, Hatford—Treatment of patients.
2293. William Soutter, Birmingham—Raising and planishing metals.
2294. W. B. Herapath, Old Market Street—Decolorizing solutions of sugar.
2295. J. S. Blockey, Leeds—Colouring matters.
2296. W. B. Herapath, Old Market Street—Treating crystallizable sugar.
2297. C. E. Spagnoletti, Paddington—Signalling trains.

15th August, 1862.

2298. M. A. F. Mennons, Paris—Sealing wax impressions.—A com.
2299. James Barclay, Gravel Lane—Manufacture of nails.
2300. Anne Shepard, Victoria Street—Obtaining light.
2301. Thomas Carvin, Landport—Screw propellers.
2302. T. F. Kirby, Aldersgate Street—Garments.
2303. James Newman, Birmingham—Metallic tubes.
2304. John Carter and James Maher, Lockwood—Power looms.
2305. J. H. Johnson, Middlesex and Glasgow—Time-keepers.—A com.

16th August, 1862.

2306. Robert Barclay, Canada West—Chronometers and time-keepers.
2307. Henry Garsido, Manchester—Marking, etching, or engraving.
2308 C. H. J. W. M. Leibmann, Huddersfield—Finishing textile fabrics.
2309. T. Knowles and W. Robinson, Manchester—Racks for window blinds.
2310. Manuel Iturriaga, Tavistock Street—Fire-arms.
2311. S. A. Bell, Epping Villas, and Thomas Higgins, Carriage Terrace—Matches.

18th August, 1862.

2312. George Chapman, Edinburgh—Reaping machines.
2313. Frederic Barnett, Paris—Lamp or lantern for street lighting.
2314. John Cimeg, Great James Street—Depositing metals on fabrics.
2315. J T. Oakley, Bermondsey—Heating stoves.
2316. W. E. Newton, Chancery Lane—Armour plating for ships.—A com.
2317. Julian Briere, Brussels—Self-acting condenser.
2318. Henning Boetius, Rochampton Street—Fireproof materials.
2319. Henry Melton, Regent Street—Hats and caps.

19th August, 1862.

2320. Thomas Wilkinson, Rathmines, Dublin—Singeing pigs.
2321. V. F. Cleuet, Paris—Supplying boilers with water.
2322. G. H. Dembinski, Paris—A motive apparatus.
2323. Simon Bouctier, Belgium—Flax spinning.
2324. W. J. Hoyle and John Proven, Halifax—Lubricating.
2325. T. H. Falkiner, Dublin—Railways.

20th August, 1862.

2326. J. G. Tongue, Southampton Buildings—Wax or fatty matters.—A com.
2327. William Whittle, Smethwick—Nails and spikes.
2328. Charles Callebaut, Paris—Sewing machines.
2329. Henry Whittaker, Church, Accrington—Healds or heddles.
2330. W. H. Hutchinson, Newton Heath—Ammonia and prussiates of potash.
2331. John Standish and John Gooden, Egerton—Preparation of cotton, &c.
2332. Samuel Wilkes, Wimpole Street—Attachment for door knobs.
2333. Charles Chinnock, Queen's Road West—Cork screws.

21st August, 1862.

2334. S. J. Paris, Manchester, and William Bate, Salford—Telegraphs.
2335. J. C. Schemmann, Hamburg—Steel.
2336. Matthew Wilkinson, Blackburn—Carding engines.
2337. George Davies, Serle Street—Steam governors.—A com.
2338. Thomas Clements, P. and J. Llewellin, and J. W. James, Bristol—Lubricators.
2339. Adolphe Boubée, Paris—Moulding glass.
2340. Adolphe Boubée, Paris—Veil protector.

22d August, 1862.

2341. S. F. Griffin, New Adelphi Chambers—Distillation of petroleum.
2342. Andrew Whytock, Little Saint Andrew Street—Making boxes.
2343. Charles Monson, Connecticut, U.S.—Rotatory engine.
2344. William Barrett, Stockton on-Tees—Railway sleepers and chairs.
2345. E. S Ritchie, Massachusetts, U.S.—Mariner's compass.
2346. James Mackay, Glasgow—Soap powder.
2347. Robert Harrington, Birmingham—Umbrellas and parasols.
2348. Harper Twelvetrees, Bromley—Washing powders.
2349. Daniel Moore, Brooklyn, U.S.—Fire-arms.
2350. George Bottomley, Leeds—Expressing moisture.
2351. Daniel Moore, Brooklyn, U S.—Fire-arms.
2352. William Carwood, Stepney, William Boaz, Bromley, and Charles Calwell, Belvedere Place—Propelling vessels.
2353. Thomas Wood, Manchester—Slide valves.

23d August, 1862.

2354. John Edwards, Aldermanbury—Railways.
2355. F. T. Moison, Paris—Cleaning organic matters.
2356. Joseph Hinks and Adam Dixon, Birmingham—Brooms and brushes.
2357. M K. Angelo, Gloucester Place—Shell-lac.
2358. Michael Henry, Fleet Street—Stuffing boxes.—A com.
2359. C. H. Rockner, Bristol—Self-acting syphons.
2360. W. E. Newton, Chancery Lane—Treating fermentable substances.—A com.

25th August, 1862.

2361. M. J. Haines, Bristol—Driving bands or straps.

26th August, 1862.

2362. H. R Hughes, Salford—Sawing machines.
2363. W. E. Gedge, Wellington Street—Stays or corsets.—A com.
2364. J. and B. Harrison, Otley—Clod crushers.
2365. George Davies, Serle Street—Washing machines —A com.
2366. Thomas Richardson, Newcastle-upon-Tyne, and Richard Allinson, Moorgate Street—Manufactnre of articles of steel.
2367. Leon Tarossou, La Madelaine, France—Washing textile fahrics.
2368. Joseph Rider, Leeds—Fencing posts, telegraph poles, &c.
2369. A. V. Newton, Chancery Laue—Instrument for cleaning windows.—A com.

27th August, 1862.

2370. Alexander Crichton, Glasgow—Looms.
2371. George Davies, Serle Street—Singeing woven fabrics.
2372. Henry Harden, Haverstock Hill—Manufacture of paper.
2373. J. A. Coffey, Finsbury Square, and Theophilus Redwood, Montague Street—Manufacture of salts of ammonia.
2374. Reuben Sims, Leigh—Pulping or slicing turnips, &c.
2375. W. H. Turner, Blackburn—Carding cotton.
2376. Charles Clark, City Road—Tea and other trays.
2377. George Lindsay, Belfast—Arranging guns in ships.
2378. W. M. Mayes, Hoxton—Wheels of railway and other carriages.
2379 R. A. Brooman, Fleet Street—Washing coal and other minerals.—A com.
2380. W. E. Newton, Chancery Lane—Producing light.—A com.
2381. J. G. Nutting, Regent Street—Manufacture of buttons.
2382. A. V. Newton, Chancery Lane—Printing from engraved plates.
2383. H. W. Cook, Norwood—Obtaining motive power.
2384. J. J. Potter, Dover—Upright pianofortes.

28th August, 1862.

2385. Joseph Kitchen, Liverpool—Ventilators.
2386. M. A. F. Mennons, Paris—Smoke-consuming furnaces —A com.
2387. M. A. F. Mennous, Paris—Assorting apparatus —A com.
2388. George Biddle, Birmingham—Manufacture of brooms.
2389. J. J. Noeckel, Rouen, France—Spinning.
2390. Elizabeth Lachenal, Little James Strect—Gas meters.—A com.
2391. William Husband, Hayle—Water valves.
2392. Grattan Cooke, Hampstead Road—Securing doors to prevent robbery.
2393 Charles Humfrey, Southwark—Treatment of petroleum.

29th August, 1862.

2394. P. L. Guilbaud and N. V. Thiré, Paris—Self-inking hand stamp.
2395. Henry Jones, Birmingham—Breech-loading fire-arms.
2396. F. H. Lefranc, Paris—Manufacture of casks.
2397. William Smith, Salisbury Street—Furnaces.—A com.
2398. John Davis, Liverpool—Spoons, forks, and similar articles.—A com.
2399. Henry Harben, Haverstock Hill—Manufacture of cotton, &c
2400. G. W. Dysonn, Tinsley—Polishing metal rods, bars, and shafts.
2401. William Owen, Rotherham—Railway wheels and tyres.
2402. P. W. Mackenzie, New Jerscy, and S. W. Smith, Brooklyn, U.S.—Vehicles to be propelled by the rider.
2403. R. C. Bishop, Jamaica—Obtaining motive power.
2404. W. Upfill, W. Morton, and W. Asbury, Birmingham—Wheels and axle trees.
2405. E. A. Pontifex, Shoe Lane—Steam traps.

30th August, 1862.

2406. E. T. Hughes, Chancery Lane—Woven fabrics.—A com.
2407. E. C. Harding and Charles Doody, Manchester—Braces.
2408. Felix Le Conte, Belgium—Furnaces.
2409. W. E. Gedge, Wellington Street—Manufacturing velvet.—A com.
2410. J. H. Johnson, Middlesex and Glasgow—Coating metallic surfaces with copper.—A com.
2411. John Meyer, Kenniugton—Jacquard cards.

1st September, 1862.

2412 J. G. N. Alleyne, Alfreton, and Julius Roberts, Middlesex—Iron beams, &c.
2413. J. Nickson and T. Waddingham, Manchester—Gronudwork for plaster.
2414 James Walker, Glasgow—Treatment of kelp.
2415. W. E. Gedge, Wellington Street—Washiug the felts of paper making machines.—A com.
2416. John Ellis, Bristol—Corsets.
2417. James Whitehead, Newton Moor—Spinning and doubling.
2418. E. G. Fitton, Ardwick—Winding yarn or thread.
2419. John Watt, Graham Street, and T. S. Haviside, Cornhill—Cottonizing vegetable snbstances.
2420. W. C. Edge, Clerkenwell—Securing Albert chains.
2421. William Clark, Chancery Lane—Obtaining light and heat.—A com.
2422. J. H. Johnson, Middlesex and Glasgow—Manufacture of braid.—A com.
2423. J. H. Johnson, Middlesex and Glasgow—Regulating the working of motive power engines, also the flow of liquid air or gas.—A com.

2d September, 1862.

2424. D. B. Pechles, Edinhurgh—Wet gas meters.
2425. Joseph Mosheimer, Manchester—Amalgamating gold and silver.
2426. William Hunt, Tipton, Staffordshire—Manufacture of muriate of ammonia.
2427. H. R. Trigg, Guildford Place—Fire escape.
2428. Richard Glanville, Bermondsey—Eugines.
2429. Richard Waygood, Newiugton—Steam boilers.
2430. William Roberts, Millwall—Regulating the flow of water.
2431. J. B Thompson, Moreton Place—Electro-magnetic machines.
2482. Sir W. O'S. Brooke, Euston Place—Telegraphic cables.
2433. Alexander Johnston, Glasgow—Pressing cotton.

3rd September, 1862.

2434 Charles Garton, Bristol—Refining sugar and distilling.
2435. Henry Elliott, Birmingham—Extracting cartridges from fire arms.
2436. F. C. Bakewell, Haverstock—Fire-places and stoves.—A com.
2437. George Walton, Bradford—Circular box looms.
2438. W. H. Atkinson, Regent Street—Studs or fastenings.
2439 William Clark, Chancery Lane—Musical instruments.—A com.
2440. Eli Dyson, Little Hulton—Spinning and doubling machines.
2441. R. A. Broomau, Fleet Street—Tools for boring —A com.
2442. R. A. Brooman, Fleet Street—Telegraph messages.—A com.
2443. P. J. Bossard, Kennington Road—Stoppers for bottles.—A com.

4th September, 1862.

2444. John Cook, Kentish Town—Carriages.
2445. B. F. Cowan, Victoria Hotel, Eustou Square—Cannon and fire arms.
2446. William Clark, Chancery Lane—Colouring matters.—A com.
2447. John Platt and William Richardson, Oldham—Burning of bricks.
2448. H. L. Emery, Foulis Terrace—Ginning cotton.
2449. R. P. Coles, Islington—Permanent way of railways.
2450. John Platt and William Richardson, Oldham—Manufacture of bricks.

5th September, 1862.

2451. William Slater, Little Bolton, and W. R. Harris, Salford—Carding engines.
2452. W. E. Bovill, James Street—Lubricating.—A com.
2453. H. W. Hart, Fleet Street—Argand and other burners.
2454. D. A. Samuel, Belvedere, Kent—Steering vessels.
2455. J. S. Margetson, Cheapside—Scarfs or cravats.
2456. William Wells, Ryder's Court—Horse shoes.
2457. W. E. Newton, Chancery Lane—Lamps.—A com.
2458. S. H. Hadley, Upper Thames Street—Manufacturing gas.
2459. J. R. Johnson, Hammersmith, and J. A. Harrison, Southwark—Taking photographic panoramic pictures.

6th September, 1862.

2460. S. H. Huntly, Upper Baker Street—Cooking apparatus.
2461. Jacob Snider, Dorset Street—Preserving fabrics, ropes, telegraph wires, woods, metals, and building materials by graphite.
2462 Samuel Pudney, Manor Street—Sulphuric acid.
2463. Hesketh Hughes, Homerton—Fluted fabric and fluting machines.
2464. E. L. Duncan, Inverness Road—Manufacture of splints.
2465. J. H. Johnson, Middlesex and Glasgow—Fire-arms and projectiles.—A com.
2466 W. J. Curtis, Tufnell Park Road—Breech-loading cannon.
2467. W. A. Richards, Cornwall Place—An improved fastening.

8th September, 1862.

2468. C. W. Williams, Liverpool—Steam boilers.
2469. F. D. Artiugstall, Manchester—Balances.
2470. J. S. Crosland, Ashton-under-Lyne—Metal tubes.
2471. James Whitehead, Manchester—Looms for weaving.
2472. James Hartshorn and William Redgate, Nottingham—Lace fahrics.
2473. Charles Fink, Berliu, Prussia—Turbines.
2474. G. W. Belding, Kiug Street—Forciug fluids from fabrics.—A com.
2475. George Davies, Serle Street—Railway signals.—A com.
2476. A. J. Aldermau, Guildford Street—Windlasses and capstans.

9th September, 1862.

2477. John Webster, Ipswich—Preventing incrustation in hoilers.
2478. Peter Rainer, The Cedars, Shirley—Watches and chronometers.
2479. Joseph Maurice, Regent Street—Preservation of ships.
2480. Fraser Selby, Surbiton—Traction engines and valves.
2481. William Hirst, Halifax—Spool tubes and cartridge cases.
2482. Joseph Walker, Norwich—Oil presses.
2483. Theodor Fleitmann, Iserlotur, Prussia—Copper.

10th September, 1862.

2484. Jones Saunders, Lewisham Road—Lamps.
2485. Jones Saunders, Lewisham Road—Railway hreak.
2486. Mark Smith, Heywood—Raising the nap on fabrics.—A com.
2487. William Rothera, Hollingwood—Rivetting boiler plates.
2488. Frederic Hands, and Henry Holland, Birmingham—Manufacture of hlack brooches, bracelets, ear-rings, &c.
2489 Joseph Vigouroux, France—An inoxydahle white metal.
2490. Andrew Barclay, Kilmarnock—Traction engines and indicating apparatus.
2491. George Ritchie, Edinburgh—Extracting the liquid portion of yeast, &c.
2492. G. T. Bousfield, Brixton—Manufacture of files.—A com.
2493. Arthur Rigg, Chester—Tipping minerals and in steam brakes.
2494. G. T. Bousfield, Brixton—Cutting files.—A com.

11th September, 1862.

2495. W. A. Munn, Faversham—Capping, loading, and closing cartridges.
2496. Thomas Steel, Bradford—Treating soap suds.
2497. George Weeks, Bromley—Trays, pots, or holders for flowers.
2498. C. R. Humphrey, Old Street—Printing machinery.
2499. Florimond Datichy, Mortimer Street—Steam engines.
2500. John Hemsley, Melbourne, Derby—Fabric for scarfs, ties, &c.
2501. R. A. Brooman, Fleet Street—Implements for cultivating the soil.—A com.
2502. William Clark, Chancery Lane—Cigar and cigarette cases.—A com.
2503. L. C. Hoyau, Paris—Portable apparatus for marking time.
2504. John Thomson, Dundee—Treatment of vegetable fibres.
2505. Andrew Barclay, Kilmarnock—Locomotive boring and winding engines.
2506. Westley Richards, Birmingham—Fire-arms and cartridges.
2507. J. and F. Walker, Leeds—Combing and carding.
2508. Peter Ward, Bristol—Sulphide of calcium and sodium.
2509. Thomas Molineux, Manchester—Pianoforte actions.
2510. Andrew Whytock, Regent's Park—Sheet-iron boxes.

12th September, 1862.

2511. A. E. H. B. Butler, Leeds—Polishing bars of metals.
2512. J. B. Smith, Bury—Washing and mangling machines.
2513. James Thom, Canterbury Place—Fitting artificial teeth.
2514. J. R. Johnson, Haumersmith, and J. S. Atkinsou, Red Lion Square—Priuting types.
2515. John Bower, Carlow—Railway sleepers.
2516. Joseph Rowell, Aberdeen—Pillars for straining wire.
2517. John Howie, Hurlford—Crossings and switches of railways.
2518. A. J. Moreau, Sherborne Street—Melting pulverised metals.
2519. Henry Higgins, Salford—Carding cotton.
2520. George Bedson, Manchester—Rolling wire.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 20th August to 8th September, 1862.

Aug. 20, 4503 Isaac Rider, Bedminster, Gloucester—"A Tap."
" " 4504 W. C. Edge, Clerkenwell, E.C.—"Fastener for Wristbands."
" 25, 4505 Henry Wilmott, Birmingham—"An Expanding Frame for Photographic Portraits."
" 23, 4506 T. W. Gore, Old Whittington, near Chesterfield—"Joint for Pipes and Tubes."
" 30, 4507 James Barwell, Birmingham—"A Tap."
Sept. 6, 4508 G. T. Wallis, Westminster, and G. E. Smith, Bristol—"Adhesive Stamp Damper."
" 8, 4509 George Burt, Birmingham—"Police or other Dark Lantern."

PROGRESS OF THE EXHIBITION.

ART. VI.

Were the present to be the last of International Exhibitions, it might seem scarcely worth while to refer again—in terms of censure or otherwise—to the conduct that has guided the existing one. But, however effectually for a time, mismanagement and bad taste have succeeded in making all classes *degoutè* with the grand collection at Kensington, where nearly everything is done that could be done, by the ungainly and graceless casket, and those who hold it, to spoil the beauty of the gems it contains—this will be forgotten, by the mass at least, and another decade or so, will see another Exhibition opened somewhere in Europe—not, let us hope, to resuscitate that which is just now coming to a close.

Its characteristics have been, throughout, such as will be "more honoured in the breach than the observance" on future occasions; but lessons and suggestions may be drawn from the failings of the present, such that no delicacy towards personal or official dignity ought to prevent their being kept prominently in view.

In our last part we referred to the fact, that it had been distinctly promised by the commissioners, through their officers, that each member of the several juries should be given a copy of the volume of awards.

This promise has been since deliberately and officially broken. We believe not a single juror (unless, perhaps, those who have undertaken to write reports may have been exceptions) has received the volume. In our own case, after some trouble, we were refused the volume, and only received it in our connection with this *Journal* at last.

This discreditable nonfulfilment of promise has had more than one motive policy. Within a month or so of closing the money boxes, an alarming deficiency, it is said, still presents itself, and the probability of a call to the extent of some £40,000 or £50,000 on the guarantors begins to be apparent. With such prospects, and with a falling off in the rate of attendance daily, to an extent that has no precedent in 1851, or 1855 at Paris, and was wholly unexpected on this occasion, it is not surprising that such paltry savings as may be effected by cutting off these volumes from the jurors have been put into practice. It will be wise, however, to bear always in mind, whence this too probable deficit, enforcing now at the eleventh hour this unhandsome parsimony, springs from. It comes not from fewness of visitors (taken over the whole period of exhibition), not from want of a copious income, but from the enormous, disproportionate, and unnecessary sums squandered upon the building. And what gave birth to this, was the attempt to erect a structure not for the Exhibition alone, and suited to it only, but one capable of being in the end turned to another and an unavowed purpose.

As to the late great and sudden falling off in the daily number of visitors, it also is traceable to the same origin. The building now proves itself to be what we predicted, in the first part of the *Exhibition Record*, it would be, at this season of the year—dark and dreary everywhere—over a large portion of its area, after two o'clock in the afternoon, perfectly gloomy. Its temperature is simply dependent upon that of the open air—the stormy excess of ventilating drafts, we cannot say provided, where forethought there was apparently none, but which is an inseparable accident from its construction, has prevented the slightest husbanding of the warm air of summer days within the building—so that, if it be chilly out of doors, it must be chilly then within, and with the superadded discomfort of drafty currents of cold air, in all sorts of places and of directions.

Public audiences, or congregations of any sort, find out these things with the sensitiveness and rapidity of animal magnetism; every one knows when he or she feels discomfort, and although few can articulate the nature or the cause of their *malaise*, all soon instinctively shun the place where it is felt. This, we believe, is one of the main causes of the late sudden falling off of attendance at Kensington.

Another motive for the suppression of these award books, however, we are compelled to believe, exists in the wish to keep things quiet as to the awards themselves, and as soon as possible to pass into oblivion the mistakes, and blunders, and injustices that these awards contain in such numerous instances. It is said, and by those who ought to know best, that, were the juries to be once more assembled, even for the purpose of having the so-called reports (of the Society of Arts' origin) read, they would have more than five thousand reclamations set before them by exhibitors who can show more or less valid grounds to charge error, or other objections to the awards made. That this is not far from the fact, some of the circumstances that came to light immediately after the publication of the awards sufficiently indicate. Take, for example, the following, from two of the daily papers, of July last:—

"The award of a medal to the Siliceous Stone Company has, after considerable agitation, not unaccompanied with scandal, been retracted; so that, after all, these irrefragable judgments may be broken in one instance; and if in one instance, why not in more? The Siliceous Stone Company had exhibited nothing whatever; and we find that theirs is not the only case of its kind. A medal has been awarded to Messrs White Brothers for the excellence of their Portland Cement, and, failing to discover the name of that firm in the official catalogue, we have made strict inquiries, the result of which has entirely satisfied us that Messrs White not only do not exhibit, but that they never so much as applied for space. Pressed on this point, the jurors say that they thought Messrs White Brothers deserving a medal for the cement supplied by them in the construction of the building. We have not heard of any rule by which persons are to be distinguished on such grounds; but, if it exist, we should very much like to know whether medals will be given to all who have helped to organise the Exhibition. It may further be asked whether the cement furnished by the fortunate firm in question was of remarkable quality, or whether it was the ordinary Portland cement of commerce. We believe that a candid reply would establish the latter alternative as the fact. Nor were Messrs White Brothers the only firm to whom the contractors resorted for cement. Messrs Knight, Bevan, and Sturge—who, together with Messrs Lee, Son, and Smith, have contributed, as exhibitors, several striking objects in Portland cement—also supplied the material for use in the building. Now, while the substance furnished by Messrs White Brothers is admitted on all hands to be neither more nor less, better nor worse, than that which may be obtained at any respectable cement wharf in London, there can be no denial of a far higher degree of merit in the composition shown by Messrs Knight, Bevan, and Sturge, and by Messrs Lee, Son, and Smith. The first-named house, in fact, takes the lead abroad as well as at home; for not only is their cement in the highest favour with the Metropolitan Board of Works for the main drainage operations, and with the Admiralty harbour authorities at Alderney—public works at least equal in importance and durability to the range of architecture in the Cromwell road—but it enjoys the full confidence of the engineers at Havre, Brest, and Cherbourg, is largely used at Kiel, and is in great request on the chief French and Prussian railways. It does so happen that Continental nations place much value upon medals; and we can imagine that two English firms, unrecognised even in the shape of 'honourable mention,' may sustain undeserved injury by an official slight of their well-established deserts.

"The feeling of dissatisfaction among exhibitors at the decisions of the juries is much stronger now than when the awards were first issued, and it is very likely a knowledge of this feeling has induced the Society of Arts to propose the question of whether medals are desirable at all.

"In another instance, one most eminent firm applied for and received the space they required to exhibit in; a few days before the opening they refused to exhibit altogether, and sent in no goods; yet, inexplicable as it may appear, this firm has actually received the prize-medal for the goods they refused to send, and which were never exhibited or in the building at all. There are three or four such cases where persons have been awarded medals who were not exhibitors or had anything in the building. The extraordinary oversight by which the whole of the cotton-spinning machinery was forgotten, and not even alluded to in the list of awards, is capable of an explanation which is never likely to be given, as the apology would only make matters ten times worse. One rather amusing oversight occurred in a very important class. In this class the goods of one great firm were so pre-eminent that the jury agreed to take them as their standard, and to award medals and honourable mentions according as other competitors were more or less successful in approaching it. These awards were duly made, but the firm whose goods had been taken as the standard were forgotten, and the mistake was not discovered till the Council of Chairmen of Juries was dissolved. The Commissioners then tried every method to remedy the unfortunate mistake (at which none were more concerned than the jury which had committed it), but they had no power. A somewhat similar oversight, it is said, occurred in the case of a celebrated piece of clockwork which is as well known in the interior as the domes themselves.

In such cases of obvious mistake which the juries themselves wish to rectify, power ought certainly to be vested in the Commissioners to allow them to reconsider their decision at any time. On the present occasion the wholesome principle of giving prizes only to *bona fide* manufacturers or inventors has been departed from, and thus retail dealers who have purchased expensive or curious articles have received medals to which they are not entitled. In all, nearly 11,000 awards have been made, of which 6,922 are medals, and the remainder 'honourable mentions.' This profusion has rather taken exhibitors aback, and all—successful or unsuccessful—seem to agree that exhibitions on the whole would do better without the medals altogether, the reward being much more satisfactorily conveyed in such carefully compiled reports of juries as were issued in 1851.

"The truth is that the only real jury in these matters is the consumer—the public, in fact, and when the awards are right, they, in nineteen cases out of twenty, merely indorse and follow public opinion, which has a much keener interest in finding out where the best or cheapest articles are to be found than any jury, English or foreign, that was ever constituted. It is an exploded fallacy to suppose that it requires the award of a medal to prevent dealers from wandering into the worst and dearest markets—from getting a costly and bad article abroad which they can get better and cheaper in the next town.''

To this last paragraph we may remark in passing, that we take exception absolute; though taken from the canonical columns of the *Times*, it is a transparent fallacy. "The real jury is the consumer;" and yet this same jury and consumer "wanders into the worst and dearest markets," and "gets to buy where he could have got better and cheaper in the next town!" Does an Exhibition medal mean anything as to merit or quality? or is it merely a peculiar form of advertisement, given to honest and to quack alike, upon the simple condition that he has successfully assisted "the Commissioners" to levy shillings at the doors?

Nothing, we feel satisfied, has kept down the torrent of complaint due to these medal and honourable mention awards, but the uselessness of remonstrance, and the policy of silence in those who have been dealt unjustly by.

The originating causes of all this have not lain with the juries, who in most cases manfully endeavoured to do their duty, and make the best of the case, but in the want of all due prevision and apparatus to enable them to make sufficient examination justly to make their awards.

Let us take one case of which we have personal knowledge.

An inventor of plates for flooring bridges, &c., applied early last year, and in due time, for space for his makers to exhibit. He received no reply whatever, supposed the space granted, and his makers, through their agent, sent in examples of the plates.

The building was opened;—no such plates were to be found. At length they were discovered *perdu* in some corner of one of the lumber yards of the Eastern Annexe. But they had been entered in the catalogue as *raw products*, and under a wrong name. The inventor applied by letter to the Commissioners to have his invention submitted to the proper jury. The secretary in reply denied that any application for space had ever been made. A copy of the letter applying for it being forwarded, it was then said (un-officially now) that the articles could not be adjudicated on, as they were not in the Catalogue. Finally, through the personal politeness of Mr R. Hunt, they were supposed to be transmitted for adjudication to Class X., where they ought to have been from the beginning. The inventor personally endeavoured more than once to obtain opportunity of explaining the subject of his invention to the jury of that Class, but after wasting a good part of two days, wholly failed in obtaining any attention; and in the issue, these plates have not even been mentioned, in connection with the Exhibition.

Yet, they are an absolute novelty within the last ten years, were pronounced publicly by Brunel to be "the best bridge flooring extant," and have been said by the author of one of the most important works on iron bridge building, "to have revolutioned that art so far as flooring is concerned."

Here was a case of simple, stupid official muddle, disgraceful in the highest degree; and we could quote a good many like it.

This was a case in which *no* award was made. If we take those in which such have been made, and look *passim* through the award book, we shall be soon convinced by the very verbiage of the awards, of the shallowness of ground, or absence of any, upon which these judgments have been, in numberless instances, pronounced.

Let us turn it up anywhere, say at Class VII., Section B, where again to our personal knowledge about as much personal attention was devoted to examination of the objects as in any other class, or as was possible under the circumstances, we read—1584—For his *effective* punching and rivetting machine, &c. On what authority is it said to be *effective?* It may be so,—we do not at all impugn it; but not a single machine in the whole Exhibition was ever submitted to trial of any sort; on what other grounds could effectiveness be judged of? 1602—1649—both have medals,—one for "a most ingenious," the other for "an ingenious" engraving machine. These are *the only two* calico engraving machines exhibited;—how discriminative!

The sugar mills nearly all have medals, and as to the brick-making machines, we believe every one exhibited has been rewarded—one way certainly, of stopping complaints and disputations, and making things smooth. 1979, a medal given "for a well-constructed linseed oil making machine," one in which there was not a particle of novelty or peculiar merit; and 1662, only the same reward, for a type composing and distributing machine—that constituted one of the most novel and striking features of the Exhibition.

Then we have most amusingly, 1850, Faucett & Preston, condemned to honourable mention only, for their engines and sugar mills, in Class VII., and the same persons awarded a medal for the same things, in Class VIII., 1845.

Again, in the latter class, we have 1970, a medal awarded to W. Robinson for *original design* (*sic*) of cask cleansing machinery; the original design of which is, if we mistake not, due to M. R. Davison, the *patentee* of it. Throughout this class we find the happy coinage of a new term as a ground for medal donation, viz., "for practical success." Will any one look through the awards in which it is used and tell us what it means.

To give one instance. We had two great centrifugal pumps in the Exhibition, excellent both in their way, as advertisements to the makers, and as first-rate "gazing stocks" for the million, useful to the ends of the Royal Commissioners. Neither were ever tested as to what return, in duty, they gave for the power expended, however; and had they been so, might not have been found worthy even of any honourable mention by a truth-loving, scientific mechanic. How stand they in the awards.

1844. Easton & Amos, Medal "for Practical Success."
1870. Gwynn & Co., ditto "for Practical Success."

Is there then no difference at all? Is a straight and a curved vane all the same in a centrifugal pump, so that both are alike practical and successful?

These are from the first pages we have turned up in opening the volume. What if we knew as much of all the other classes as we do of some eight or ten of them, if such be a sample of the adjudications in all; but we rather incline to think that these are favourable examples of the adjudications of honour. These complaints of ours, which proceed from no private motive or ill feeling, but from an earnest desire to see the ends of industrial exhibitions better carried out in future, are not confined to England, but fully shared in by the exhibitors of foreign nations; and, in proof of this, we would direct attention, amongst others, to an article, "Sur les omissions au catalogue des recompenses de l'exposition de Londres en 1862," in the "Union Industrielle" of 25th September of this year—an old established and highly respectable French industrial journal.

Within the last few days of the expiring month (September), some *disjecta membra* of the falsely called "Reports of the juries" have been produced. These were promised to have been completed in August last, and the *alter ego* of the Commissioners, now on the eve of October, fulfil their volunteered engagement, of doing the duties that belong to the Com-

missioners, by sending forth a lot of unbound, stitched, and disconnected pamphlets, with an apologetic notice, that rather than delay longer they have thought it better to publish this than nothing.

What they have published consists of a set of individual essays devoid of all juridic authority; the following classes being wholly omitted, so far at least, viz:—

6, 9, 13, 14, 15, 16, 19, 22, 31, 32, 33, 35, 36.

When, or if at all, the essayists of these classes are to make their appearance we are not yet informed. We fear we shall be cheated out of the "suitable morocco binding" after all—it too must go to help the guarantors.

ABSTRACT OF AN INVESTIGATION ON THE EXACT FORM AND MOTION OF WAVES AT AND NEAR THE SURFACE OF DEEP WATER.

BY WILLIAM JOHN MACQUORN RANKINE, C.E., LL.D., F.R.SS.L. AND E., ETC.

The following is a summary of the nature and results of a mathematical investigation, the details of which have been communicated to the Royal Society.

The investigations of the Astronomer-Royal and Mr Stokes, on the question of straight-crested parallel waves in a liquid, are based on the supposition that the displacement of the particles are small compared with the length of a wave. Hence, it has been very generally inferred that the results of those investigations, when applied to waves in which the displacements are considerable as compared with the length of wave, are only approximate.

In the present paper, the author proves that one of those results, viz., that in very deep water the particles move with an uniform angular velocity in vertical circles, where radii diminish in geometrical progression with increased depth, and, consequently, that surfaces of equal pressure, including the upper surface, are trocboidal, is exact for all possible displacements, how great soever.

The trochoidal form of waves was first explicitly described by Mr Scott Russell; but no demonstration of its exactly fulfilling the cinematical and dynamical conditions of the question has yet been published, so far as the author knows.

In "A Manual of Applied Mechanics," (first published in 1858), the author stated that the theory of rolling waves might be deduced from that of the positions assumed by the surface of a mass of water revolving in a vertical plane about a horizontal axis; but, as the theory of such waves was foreign to the subject of the book, he deferred until now the publication of the investigation on which that statement was founded.

Having communicated some of the leading principles of that investigation to Mr William Fronde, in April, 1862, the author was informed by that gentleman that he had arrived independently at similar results by a similar process, although he had not published them. The introduction of Proposition II. between I. and III. is due to a suggestion by Mr Fronde.

The following is a summary of the leading results demonstrated in the paper:—

Proposition I. In a mass of gravitating liquid, whose particles revolve uniformly in vertical circles, a wavy surface of trochoidal profile fulfils the conditions of uniformity of pressure: such trochoidal profile being generated by rolling, on the under side of a horizontal straight line, a circle, whose radius is equal to the height of a conical pendulum that revolves in the same period with the particle of liquid.

Proposition II. Let another surface of uniform pressure be conceived to exist indefinitely near to the first surface; then, if the first surface is a surface of continuity (that is, a surface always traversing identical particles), so also is the second surface.

(Those surfaces contain between them a continous flow of liquid.)

Corollary.—The surfaces of uniform pressure are identical with surfaces of continuity throughout the whole mass of liquid.

Proposition III. The profile of the lower surface of the layer referred to in Proposition II. is a trochoid generated by a rolling circle of the same radius with that which generates the upper surface; and the tracing-arm of the second trochoid is shorter than that of the first trochoid by a quantity bearing the same proportion to the depth of the centre of the second rolling circle, below the centre of the first rolling circle, which the tracing-arm of the first rolling circle bears to the radius of that circle.

Corollaries.—The profiles of the surfaces of uniform pressure and of continuity form an indefinite series of trochoids, described by equal rolling circles, rolling with equal speed below an indefinite series of horizontal straight lines.

The tracing-arms of those circles (each of which arms is the radius of the circular orbits of the particles contained in the trochoidal surface which it traces) diminish in geometrical progression with an uniform increase of the vertical depth, at which the centre of the rolling circle is situated.

The preceding proportions agree with the existing theory, except that they are more comprehensive, being applicable to large as well as to small displacements.

The following proposition is new:—

Proposition IV. The centres of the orbits of the particles in a given surface of equal pressure stand at a higher level than the same particles do when the liquid is still, by a height which is a third proportional to the diameter of the rolling circle, and the length of the tracing-arm (or radius of the orbits of the particles); and which is equal to the height due to the velocity of revolution of the particles.

Corollaries.—The mechanical energy of a wave is half-actual and half potential: half being due to motion, and half to elevation.

The crests of the waves rise higher above the level of still water than their hollows fall below it; and the difference between the elevation of the crest and the depression of the hollow is double of the quantity mentioned in Proposition IV.

The hydrostatic pressure at each individual particle during the wave-motion is the same as if the liquid were still.

FRICTION BETWEEN A WAVE AND A WAVE-SHAPED SOLID.

In an appendix to the paper, is given the investigation of the problem, to find approximately the amount of the pressure required to overcome the friction between a trochoidal wave-surface and a wave-shaped solid in contact with it. The application of the result of this investigation to the resistance of ships was explained in a paper read to the British Association in 1861, and published in various engineering journals in October of that year. The following is the most convenient of the formula arrived at:—Let w be the heaviest of the liquid; f, the co efficient of friction; g, gravity; v, the velocity of advance of the solid; L, its length, being that of a wave; z, the breadth of the surface of contact of the solid and liquid; B, the greatest angle of obliquity of that surface to the direction of advance of the solid; P, the force required to overcome the friction; then—

$$P = \frac{f w v^2}{2 g} L z (1 + 4 \sin^2 \beta + \sin^4 \beta).$$

In ordinary cases, the value of f for water sliding over painted iron is ·0036. The quantity, $L z (1 + 4 \sin^2 \beta + \sin^4 \beta)$, is what has been called the "augmented surface." In practice, $\sin^4 \beta$ may in general be neglected as being so small as to be unimportant. W. J. M. R.

30th September, 1862.

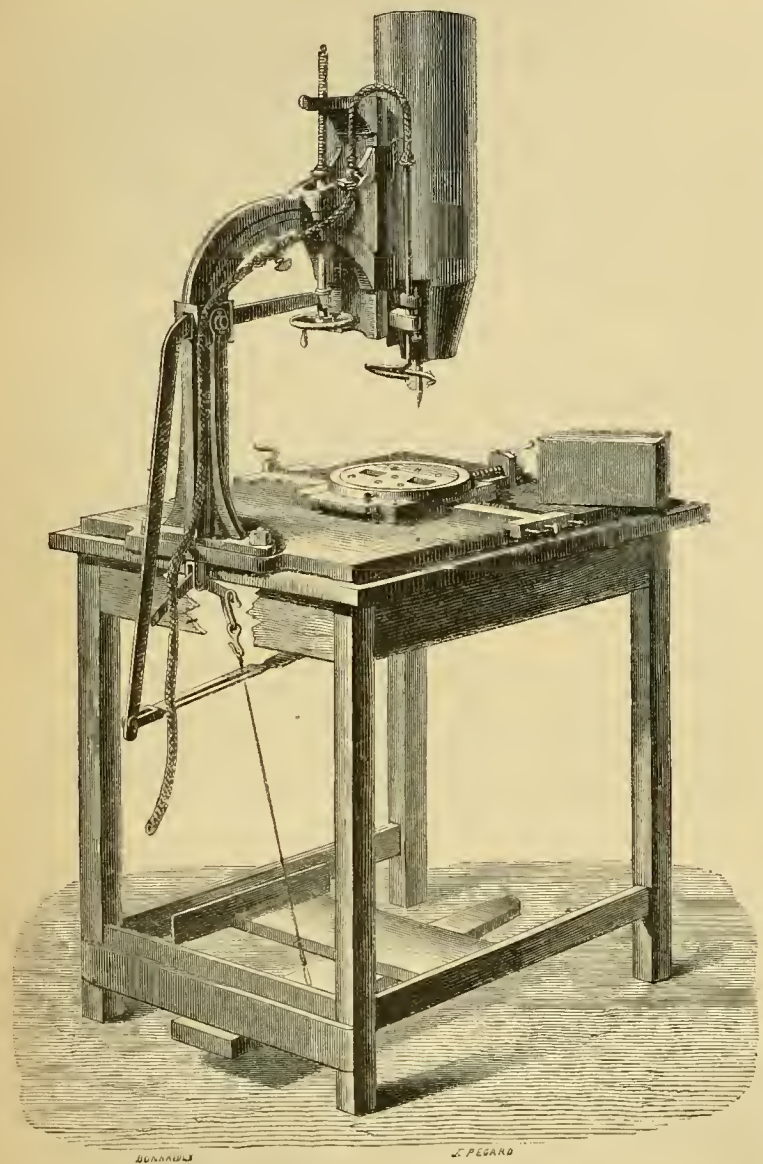
STEREOTYPOGRAPHY.—PROCESS FOR OBTAINING MUSIC STEREOS FOR TYPOGRAPHIC PRINTING.

A very curious process for obtaining stereotype music plates is exhibited by the French Imperial Printing Establishment, under the name of "Pyrostereotypography." The following interesting notice is published by this establishment:—"All the most eminent printers, from the beginning of the sixteenth century down to the present time, have devoted a great deal of attention, and a vast amount of labour, to the means generally employed in printing music in the typographic press. In a work by Nicolas Wollick, printed at Cologne in 1501, there are several pieces of plain chant printed in moveable type. In 1503, Ottavio Petrucci in Italy, Pierre le Hutin in 1525, Jacques de Sanlecque and Guillaume Le Bé, from 1537 to 1545, in France, brought the art of engraving and printing music to the highest degree of perfection possible in those days. In 1552, Adrien Leroy and Robert Ballard obtained from King Henry II. the exclusive privilege to print music, the consequence was that this industry remained at a stand still; and it was only two centuries later, in 1754, that Breitkopf, of Berlin, improved on the experiments of his predecessors, and made a very remarkable progress in music printing in moveable type. Cooper of London, Reinhardt of Strasbourg, Gaudo, Brothers Fournier, and the firm Olivier & Godefroid, of Paris, soon followed in his footsteps. In our own time, Messrs Duverger, Tantenstein, Curmer, and Derriey have also endeavoured, with more or less success, to solve the old problem of substituting some cheap process for printing music for the engraved or stamped metal plates in use up to the present time.

"We cannot notice here the many ingenious, but often insufficient processes imagined by these numerous inventors. We will only observe that the reason why Messrs Duverger and Curmer have succeeded in producing beauty of execution, although at the expense of economy perhaps, is this, neither of them has used moveable type exclusively, and both have had recourse to stereotypography. The French Imperial

Printing Establisbment exhibits, for the appreciation of typographers, solid plates of music made in one castiug, in a wooden matrix, which is engraved hollow by the burning machinc so well known to calico printers.

"The process by which these plates are made is extremely simple, and very much resembles that which is employed in stamping music notes on tin plates; in both processes women may be employed.



"A block of lime tree wood, properly prepared, is substituted for the metal plate. On both, the positiou of and the distance between the staves, the division of tbe measures, and tbe distribution of the notes, are first drawn.

"The block is then placed in under the hurning machine represented in the accompanying engraving, which is provided with several steel punches in succession, which represent the signs, the keys, or the notes, and which, when heated by two jets of gas, are forced into the block as many times as these signs, keys, or notes appear on the page; they enter the block to a certain depth, and leave a clear and uniform impression. In order to complete the mould or matrix, bands of pasteboard, of the thickness of the plate, are added, and brought down to the edges of the block; thc mould is closed by a well prepared east iron plate, aud adjusted between the cheeks of a small press, hinged on to a tub filled with water.

"By this arrangemeut of the press, the mould or matrix can be placed either in a horizontal position for adjusting the pieces, or in a vertical position, to allow the matter in fusion to run out in the ordinary way, through a hole made for the purpose. The water in the tub helps to cool the mould or matrix. By applying the process above described to typography, music printing, aud curved or diagonal line engraving, which is so difficult to priut with the ordinary materials used by printers, and so costly to engrave, will be greatly facilitated. A very simple, and not very cumbersome material, the cost of which barely amounts to 1000 francs, would suffice for a regular and considerable demand."

MARSH LAND ENGINEERING.

THE INUNDATIONS AND THEIR CAUSES.

If we look at a surface-shaded or contoured map of England geologically coloured, we remark that (as is very often true of other lauds) the highest elevations of our island and the oldest rocks are found towards the west and north-west side. From the north-east runs down like a mid rib, in a folding tortuous course, from about Whitby, in Yorkshire, into Somerset, an almost continuous low ridge of hills, of the older tertiary rocks in great part—aud upon the gentle declivities of these to the eastward, repose the various beds of clays, chalks, gravels, sands, and other comminuted matters tbat constitute the preponderant mass of material of the great plain (speaking roundly) that slopes off iusensibly to the shores of the North Sea and Germau Ocean. All is of sedimentary deposits of incoherent matter, the last residues that denudation bas left of the water moved material of a vast river basin — which probably once drained a great Nortbern Atlantic Continent, and which may bave once bifurcated with the Rhine and Elbe basins, as the Missouri joins with thc Mississippi.

This eastern platcau of England falls to its lowest and flattest, in the region long known as The Fens, which may be roughly estimated as covering about 4000 square miles of low-laying land—though much less than that (probably about one-fourth) forms the surface of "The Fens" proper.

The latter constitutc a most peculiar district, interesting to the agriculturist and geologist, the metcorologist and engineer. Its surface (whose natural inequalities, with the exception of a few isolated and slightly-elevated patches, such as that upon which Ely is founded, and which stand like islands in the great plain—indeed, the first alluded to was called "The Isle of Ely," are almost evanescent), possesses, broadly considered, an extremely slight general fall to the east and north-east, viz., towards the low margin of that shallow and muddy sea we call the Germau Oceau, aud to its great estuary, the Wash.

The larger portion, as we now behold it, cut up, poldered, sub-divided, aud banked across and around, with a complication of drains and water-courses of all sizes, from those of a tile-drain or a ditch, to arterial channels bigger than the Thames ahove London, and most of these, between banks raised *above* the level of the plain, appears to tbe visitor, unaided by good maps and some topographical and engineering knowledge, a watery network of inextricable confusion.

The surface has, in the course of ages, been won, bit by bit, from the domain of the sea, and the Fens of to-day are the result of persevering industry in embanking out the waves from one tract after anotber, from a date probably even anterior to the Roman invasion of England. One great bank, extending many miles, is still knowu as the Roman Dike. Some of the greatest reclamations, however, were made in the seventeenth and eighteenth centuries.

The land bas nearly all been once tbe silty bed of the sea, and to a vast depth consists of a mixture of impalpably comminuted dark-brown clay, with very fiue siliceous sand, without a single stone or pebble. Peat in mixture more or less forms the surface in many places. The soil, firm and dense enough when tolerably dry and left iu repose, is readily reduced to a quaking pap, like thick porridge, when agitated or exposed to water. By the action of running water, it is eroded away with immense rapidity, and when water-soaked the banks of it slip away in vast masses, and show mobility upon angles of inclination that, with more stoney or gravelly soils, would ensure repose. In fact, the angle of repose is unusually small.

The great surface of the plain is in very few places, at a level to be *permanently submerged*, were the sea left to regain its dominion; it is, in fact, nearly all above tbe level of low-water of spring tides, but much of it below that of high-water even of neap tides, bence the embankments

have for their office to keep off the land the tidal-waters as they rise above a certain level in the rise of flood.

The Witham, the Welland, the Neue, and the Ouse are the four great natural outfalls for the land-waters of the country. Their margins, like those of the Po and other rivers of Northern Italy, are embanked for miles, and as through these, laterally, the land-waters, *i.e.* the rain, of the country must be discharged, so the banks are perforated with sluices wherever the lateral or secondary channels join into the main ones. These are generally flap sluices, self-acting, to open outwards, but preventing the regress of water from the main outfalls. These sluices are also generally provided with rack-sluices, moved up or down by hand, locally called "cloughs," to seaward of the flaps, as a preventive against accident. The tide flows more or less freely, up and down the great channels of outfall, viz., the river-courses, within which, in the great drains, as reservoirs, the land-waters coming down are impounded during the higher states of tide and debouched, at or near low-water, through these flap-sluices, or, if requisite, pumped to a lower level by wind or steam power.

The interval of time available for discharge through these, and the lowest level to which the discharge shall be possible, depend upon what may be "the establishment" of the tide in these main channels of outfall. Were the latter capable of no obstruction whatever, to the flow upward and downward of the tide wave of the sea that reaches the shore, there would be the full interval both in time and in depth that is found upon the coast for discharge at every inland point along these outfalls. Such a condition, however, is not possible, and in proportion as the course of any one of these channels is longer and more sinuous, shallow or obstructed, will the time for, and the depth to which, discharge of the upland waters may be made, be obstructed. All modern improvements, in this and like countries, depend upon effecting an increase in this time, and adding to the depth or lowest level of discharge, by reducing the obstructions to the rapid rise and fall of the tidal-stream in these main-outfall channels. And this is done simply by *straightening*, *deepening*, and *shortening* them. In the mere embanking out the sea direct, or the main river channels, from the sea, the practice of our Danish forefathers in Canute's time was nearly the same as our own; but they followed all the tortuous windings and turns of the natural bed or deepest line of the river channel.

It remained for modern engineering science to see, that, as the discharging power of every river, tidal or not, depends mainly upon its capacity of bed and rate of inclination of the water-surface, *i.e.*, upon the wet perimeter of the channel and fall per mile, so, with a given total difference of surface-level between the mouth and any higher point, will the discharging-power be greater, as the total length of the channel is made shorter, for that is in fact to increase the ratio of fall per mile. Upon this obvious principle is based two of the great improvements carried out in modern times in the Fen country, namely, the Nene outfall and the Eau brink-cut, in each of which the naturally sinuous course of these rivers was made straight, by diverting them into artificial channels, which shortened their courses several miles above their mouths. In river beds, up and down which a tidal-stream sets, the effect of such an operation, at the lowermost point of the new cut, is to alter the tidal-establishment there, as well as to increase the rain-discharging power of the stream, for, as the discharging capacity has been increased, the tidal-stream reaches farther up and farther down: the residue of a previous tide, held undischarged for want of time for its delivery between one tide and the next, is no longer so imprisoned, more of the tide ebbs off in a given time, and so the level of low-water at the place is lowered, *i.e.*, the tide runs down more nearly to the same level as the low-water of the open sea. This was actually the case after the completion of the Eau brink-cut by Telford in 1821, to such an extent, that the tidal-establishment of the river Ouse was affected by the improvement up to Denvir sluice, seventeen miles above the mouth at King's-Lynn, and the level of low-water at the latter became lowered at spring tides by about *six feet*.

But in every river or river estuary the further effect of such a disturbance of regimen of the stream is to react upon the channel itself. The increased discharge is due to an increased velocity of stream, this produces increased erosion and wear of the bed, and when this consists of such material as the soil of the Fen district, just described, *the scour* produces a rapid increase both of width and depth of channel, the bottom and sides of which are lifted and carried away as suspended mud by the increased velocity of current; and this proceeds until at last *the new channel is so enlarged* by the natural operation of the stream that, although retaining the increased discharging-power, the velocity is brought back to what it was before the alteration. This is inevitable, because water running over soil of a given sort *can* only run at a given velocity, leaving the channel unacted upon. If, for example, the particles of mud of the banks or bottom be of the average size of pin's-heads, at a certain velocity the current will sweep them away down the stream, and they will continue to be so swept off and removed until, by the enlargement of channel so produced, the velocity is diminished down to the point at which running-water can no longer lift such particles.

This also took place at the Eau brink-cut, the mean cross-section of which is now greatly larger than it was as originally and finally excavated by Telford, and took place to such an extent at the Nene outfall, that the channel there was deepened fifteen feet in a single year.

But again, a third condition comes into play on the enlargement of such a channel. Where the velocity of the running-water is greatest, there the scour and removal of solid material is also greatest. Now, in a straight river channel the velocity is greatest of all, at some point in the middle of the stream, and between the surface of the water and the bottom; and at the bottom, and in contact with it, the velocity is greater as the point is nearer the middle of the stream. The middle part of the channel is, therefore, eroded fastest and most; but in the Fen country and the Eau brink-cut, to which the rest of our observations will more particularly apply, the slobby mud banks on either side the stream have become formed out by its action until their contours rest at or within the angles of repose of the soft material taken in section across the channel. When, therefore, the middle portion of the channel becomes scoured away and deepened, these slob banks cease to be in repose—they begin to slip inwards towards the deepened centre of the channel, where they are in turn eroded and carried away. Upon these two trains of operation, mainly—viz., the lifting into suspension and carrying off of silty particles from the bottom, and most at the centre, and upon the slipping in of the sides—depends the enlargement of such river-courses, when, by any circumstance, natural or artificial, the average current velocity has been increased.

We have premised these remarks, because in their application will be found the true key to those great disasters that during the present year have afflicted the Fen country, and from the second of which it is at this moment still suffering. The remedial operations that these accidents have necessitated are of a highly interesting character, and we propose to give now a brief description of them.

The circumstances of the first accident—viz., the fall of the great sluice at the entrance of the arterial drain into the Eau brink-cut, called the Middle-Level Sluice, on the 4th May last, and of the resulting inundations of several thousand acres of land, by the tidal-waters rushing unimpeded at high tide up this great channel and overtopping its banks, have been familiar to all through the public papers. The sluice itself consisted of a series of piers, upon a continuous cill, right across the middle-level, *at its junction with the Eau brink*. The piers were provided with hollow quoins; and single gates of timber, meeting with a mitre pointing outwards, (like common lock gates), formed the self-acting sluices against the return of tide through the apertures between the piers—a bridge of brick arches, resting on the piers, spanned the whole.

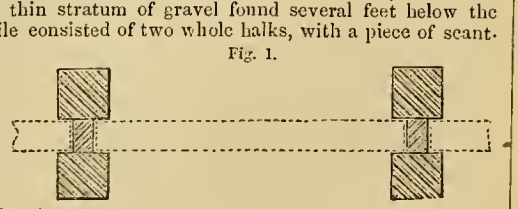
It gave way by the piers sinking, great crevaces opening in the masonry, the piers getting out of plumb, and finally nearly the whole sinking in ruin, and disappearing beneath the muddy waters. Our readers are aware of the consequences that followed, and of somewhat of the abortive attempts that were made to dam across the Middle-level drain at a higher point, so as to arrest the up-flow of the tide, and confine it to within the short *cul de sac* to be so formed.

The operations commenced by M. Müller, a Dutch engineer, to lay a dam of fascines and clay, though unquestionably correct in principle were abortive and unfortunate, both through unforeseen accident and through the want of any adequate supply of fascines. These—nor those which resulted in the destruction of the timber-piled bridge adjacent, we do not propose to refer to, but to give a brief description, and as clear as may be, without detailed drawings, of the works of the dam, now practically completed across the drain under the direction of Mr. Hawkshaw, and of the discharging apparatus by syphons over the same, by which provision is made for the discharge of the upland waters.

This now celebrated dam was proceeded with as follows. It must be borne in mind that the problem to be solved was to construct a dam, in the most rapid manner, that should be effectual and permanent, across a great canal, between two and three hundred feet wide, formed *all* of material that upon the least agitation, with water present, became mud and then pap, and with a tidal-scour running constantly up and down at the rate of six feet per second sometimes, and to a depth occasionally of more than twenty feet. A more serious undertaking, though not a work of vast magnitude, has seldom been presented to the civil engineer. The result of the measures taken has been one of complete success, as we can testify from personal observation.

Across the channel two parallel rows, 30 feet apart, of double piles were driven, at distances of 7 feet from centre to centre, until their points reached a thin stratum of gravel found several feet below the bottom. Each pile consisted of two whole balks, with a piece of scantling of about 8 in. × 4 in. between them, the line joining the centres of each pair being in plan up and down stream, each compound pile therefore formed a pair of grooves back to back, fig. 1. A

Fig. 1.



number of panels of half-balk thickness, bolted and otherwise secured together, each of about 7 feet square, were prepared to drop into these grooves. And the first set, reaching right across both lines of piling, being provided with iron-shod cutting edges at bottom, were driven down by dollies, right into the mud of the bottom, between the guide or groove-piles, until their top edges were rather below the bottom of the channel. This done, other panels, with flat edges top and bottom, were placed ready in the pile-grooves for being dropped into place, and a vast quantity of puddle, of the best material procurable, was laid ready on the adjacent banks. At the moment of slack water on the turn of tide, the panels were dropped and forced down into place in both lines of piling, and instantly the filling in between with puddle was urged on, the guide-piles having been previously properly tied together to prevent their being pressed outwards by the mass of stuff between them.

It was stated in the public prints that the operation was at first unsuccessful, and it is a fact that some of the panels first dropped in, having in view a rather different mode of procedure as to the filling than that finally adopted, were again withdrawn, not in consequence of any failure whatever, but as a result of the exercise of judgment, guided by indications that the work itself suggested in its progress. The particulars of this we cannot, through want of space, go into, nor is it necessary we should, for no doubt this interesting operation, of which we here present the first technical sketch that we believe has been laid before professional readers, will be given a full account of, in the approaching session, at the Institution of Civil Engineers, when this and other details will probably be fully described.

The dam was, in fact, now complete, slack water was secured within it, the scour was at an end, and with it the tidal inundation; but the upland-waters, the rain-fall of the whole Middle-level area of country, were impounded. Some means must be devised to give these outlet. Either the new dam must be pierced to permit pipes and valves to pass through it, or some old banks must be pierced somewhere else, in more than one place, to vent this water, by constructing a new sluice. Either would be a perilous and formidable work. At this juncture it was proposed to draw off the land-waters by passing them over (not through) the dam by a number of large syphons laid on top of it, and parallel to each other in the line of the channel.

The suggestion is reputed to have come from Mr. Appold, well known in connection with the pump which goes by his name. We know not how this may be, but similar applications of the syphon, and upon a very large scale, are by no means new. Iron syphons were employed many years since by Sir William Cubitt, in, we believe, the Fen country, and with the peculiarity that both ends dipped into cylindrical vessels always full of water, the indraft and discharge taking place through the annular spaces between these and the syphon ends, by which means, when once full of water, the syphon always remained so. Syphons were also proposed and employed by Mr. Mallet, in connection with the arterial drainage of Ireland several years since, and with certain peculiar adjuncts for regulating outfalls, a full description of which may be found in Weales' Quarterly Papers. But long anterior to either of these, the syphon, formed with great skill *in masonry*, and without either iron or timber, was employed in France, with like objects, about eighty years ago, we believe, and will be found figured and described in the *Annales des Ponts et Chausees.*

However, with whomsoever on this occasion originating, the project was most judicious, and its complete success so far, which we have no doubt will continue, will eventuate, if we mistake not, in revolutionising sluice-work in the Fen country, and in all others like it; and in the substitution of properly-constructed syphons for the old forms of brick and timber *flaps and cloughs.*

The following is the general mode of construction adopted by Mr. Hawkshaw for those syphons, of which there are sixteen in all, alike, each 3 feet 6 inches diameter inside, cast in lengths from 3 to about 9 feet, and with leaded spigot and faucett-joints, and four large double lugs, and 1½-inch bolts and nuts further connecting each joint.

In line up and down channel, or transverse to the dam, each syphon consists of about 30 feet of horizontal pipe, laid on top of the dam; of two inclined pipes, with slope of about 2 to 1, on the inner and outer faces; and of two terminals—the inlet and outlet ends, bent again to the horizontal line, and provided both with valves. The total distance horizontally between the ends of any one syphon is thus about 160 feet. A complete system of piled framing has been driven at both sides the panel dam, with parallel inclined sleepers of balk timbers, along which the inclined syphon-pipes are laid, and by proper bracing and iron tyes, &c., made perfectly secure from subsidence or change of position. At the inlet and outlet ends a complete solid range of close-piling has been driven right across the bottom of the channel, and on the heads of these piles, properly hollowed out, the terminals of the syphons rest. The interior mass of framing which carries the syphons, independently altogether of the dam, as a support, is connected with three lines of footing-piles; and exterior of these latter, and also connected with them, are, at the inlet and outlet sides, large and slightly-inclined aprons of half-balk, spiked down on piling to prevent any wash disturbing the bottom. Each syphon is provided with a flap valve at each end, that at the inlet end is simply a loose-hanging flap of timber, which opens spontaneously, and flies up towards a horizontal position within its valve-box as soon as the syphon begins to run. The outlet valve is a cast-iron flap, hinged at top, balanced, and capable of being held fast and shut, by a bridle, the construction of which, though simple, would be scarcely intelligible without drawings. This flap is opened also by the current of water issuing from the outlet end as soon as the bridle is withdrawn.

Both valve-cases and valves are prepared to unbolt and draw to surface at pleasure by the aid of a helmet-diver.

The syphons are put into action by exhausting the air from the interior by a triple-cylindered set of air-pumps, worked by a vertical 10 H.P. high-pressure engine, placed on the south bank of the channel at the dam. A 12-inch main-pipe, with flanged joints, runs across the dam over all the syphons, and a branch drops vertically to the crown of each syphon, and is provided with a slide-cock, so that any one syphon can be exhausted separately. The air-pumps are about 16 inches diameter and about 2 feet stroke, each with three India-rubber valves—one below, one in, and one above the piston, all opening upwards. The pumps are wrought by a three-throw crank, and the general arrangement seems judicious.

As the method of exhaustion has been adopted, for the putting these syphons to work, it is obvious that to stop them one large sliding-valve, across the horizontal or highest part of each syphon, would have answered the purpose. The two valves, however, were employed—first, because it was at first matter of some indecision whether exhaustion of the air, or filling by water pumped up into a tank, should be employed to set the syphons to work; and secondly, that inasmuch as the highest point of the centre of the pipe of the syphons is only about 21½ feet above the like point at the discharging end, and not much above high-water of springs, it was desirable, by a self-acting flap, to prevent the possibility of tidal-water, on any extraordinary occasion, passing back through the syphons over the top of the dam. We ourselves feel pretty certain that the method of filling with pumped-up water, to set each syphon to work, is greatly preferable to that of exhaustion of the air by air-pumps, and far more economical of power. We are also persuaded that if exhaustion be employed at all, it would be best done by simply condensing steam in a large cylindrical vacuum vesssel like a steam-boiler, whose capacity should be about four times that of one syphon in this instance. It was proved by Mr. Mallet several years since (see Weales' Quarterly Papers), with reference to the Atmospheric Railway, that this method of exhaustion was mechanically much more economical than any form of air-pump, and less liable to derangement or accident, and Mr. Nasmyth, about the same time, patented an arraugement founded on the same principle for the like object.

When fully completed, the spaces between the framing, &c., under the syphons at both sides of the dam, will be filled in quite solid with hard puddle, and we believe sheeted or bricked over, so as to permanently secure from action of water all within. Six of the syphons have been already experimentally at work, and were found to run sensibly, with a difference of head between the water at opposite sides of the dam, of only 3 inches, and would probably have run with less.

The completion of this dam put an end to the Fen inundations, produced by the giving way of the middle-level sluices.

The waters had scarcely "assuaged," however, when the giving-way of another, though smaller sluice, has produced a repetition of disaster. We cannot give a better account of the circumstances of this second accident than the following:—

"At about 6 o'clock on Saturday evening, the outfall sluice of the Marshland Smeeth and Fen drain, an important arterial drain running into the Ouse, about 200 or 300 yards northward of the ruined Middle Level sluice, became the subject of an accident precisely similar to that which destroyed the last-named work on the 4th of May last. The result has been again to flood a portion of the Fen country, and the extent of the inundation will very probably be in a day or two as great as that of the celebrated "Middle Level deluge." It may be recollected that in consequence of that "deluge" a great quantity of water had to be discharged off the drowned lands through the Marshland Smeeth and Fen drain and the adjoining Marshland sewer, both of which run parallel for a considerable distance to their outfall sluices, the one draining the fens and the other the higher lands of Marshland proper. This unusual test of the two sluices caused some apprehension as to their safety; and, in consequence, shortly after the Middle Level inundation, both sluices were strengthened by an "apron" of clunch, held up by piles, being laid against the outer face, and the adjoining banks faggotted and further secured by walls of sheet piling. In the case of the Smeeth and Fen drain these precautions have proved unavailing. Nothing peculiar was noticed about the work until about ten minutes before the injury was fully developed. At that time the sluice-keeper, Smith, casually observed what he thought was a log of wood across the roadway over the sluice-bridge, and going to the spot found it was a deep and extensive

fissure. He had scarcely time to examine it when the bank against the southern side of the sluice fell in with a crash, leaving a gap 40 feet wide in the roadway. The cause of this evidently was that the water rushing down the drain had undermined and scoured away the earth behind the southern flank walls of the sluice. Of course, as soon as the misfortune became known the Marshland Smeeth and Fen Commissioners took steps to prevent its further extension. Under the direction of Mr. W. D. Harding, civil engineer, about 200 navvies were set to work to form a dam with sacks of earth, close to the first bridge above the sluice, near St. Mary's Church, the parapet of the bridge being thrown down to facilitate the tipping of the sacks. The work was continued all Saturday night and Sunday. The number of navvies employed on this work, and in raising the bank between the Fen drain and the Marshland sewer, was gradually increased to about 400; Mr. Harding, C.E., Mr. Valentine, C.E. (the engineer of the Hunstanton Railway), Mr. Durrant, borough treasurer of Lynn, and other professional gentlemen took a part in directing operations. By 3 o'clock in the afternoon not less than 3,000 were assembled, and anxiously watching the defensive works. Several hundreds of sacks laden with earth and clay from the adjacent banks were rapidly tipped from the bridge into the drain to form a temporary dam, and by 4 o'clock the heap reached the crown of the arch. Additions were still made to it to strengthen it against the advancing tide, and some faint hopes were entertained of success; but at about a quarter-past 4 o'clock (high water being at 6 o'clock) with very little warning the dam gave way bodily, and the entire mass, having been carried some score of yards up the drain, was then disintegrated and sank out of sight. The tidal water, having thus overcome the obstacle, went with a rush and a roar, carrying with it great quantities of earth and a number of trees which had been cut down and laid on the bank for future use. The water is again flowing over the banks upon some of the very same lands which had just been recovered from the former inundation. The lands flooded by Sunday night's and this morning's tide, already amount to fully 1,000 or 1,100 acres—of which some 500 acres are in Marshland proper—the so-called "high-land" which had fortunately escaped the former inundation, and has rarely for centuries past been subject to such misfortunes. Up to the time of writing this, the sluice still stands, but its walls are very seriously cracked from top to bottom, and large portions of the foundations are washed away. The gap which the water has made for itself in the southern bank is now 50 yards in length and half as much in depth, and the precipitous sides of this gulf fall away at intervals in large masses. The northern bank is also exteusively fissured, and behind the outer wing wall on this side is a large conical hollow, like the vortex of a whirlpool, in which the earth continually sinks, proving that the water has undermined the foundations beneath. The banks of both the Fen drain and the great sewer are already much injured by the scour through them, and are caving in in several places. In two or three instances near the sluices, portions of cottage gardens, with their crops of vegetables, have slidden down into the rushing stream."

The attempt thus to form a dam with sacks of earth thrown in at the seaward side of the single arch of St. Mary's Bridge having failed, as it was almost certain it must, by the mass of sacks being swept bodily away, Mr. Harding, C.E., proceeded at once to drive, at about 2 feet apart, all along the seaward side of the parapet face of St. Mary's Bridge, a row of piles, so as to form an open grid, resting against the ring pens of the arch, &c., of the bridge and in the soil below, and again began to throw in sacks of earth outside these.

We saw the work ourselves on Monday evening the 6th October, when the spring tide was nearly at the highest, and when there was already a pressure of some 15 feet of water against this dam, upheld thus only by the lateral stability of the bridge, which is a common 20 feet road-bridge of brick, of one arch of about 25 or 30 feet span. They had strutted the bridge by diagonal balks laid from footings in both banks on the land side to the key-stone. Altogether the work done within 48 hours, and the skilful way in which it was done, reflected great credit upon the engineers in charge, none of whom, however, had we the pleasure of meeting.

Although dammed here, at St. Mary's Bridge, about half a mile back from the ruined sluice, at the debouchure of the Marshland drain into the Eau Brink, the intermediate banks of the drain on one side were so low that the tide was going over for nearly the whole length, and falling into the parallel drain, passed up through the second arch at St. Mary's Bridge that spans *it*, and so still inundated the country within. This overflow, however, we find has since also been stopped by raising the banks all along, and so for the present this second inundation is at an end.

And now let us return to this second sluice that has given way. It was a large brick and stone structure, consisting of four splayed wing walls, with a large compound flap and clough within them, the whole constructed through the bank of the Eau Brink, upon a piled foundation, and at such a level, that at low water a long steep slope of slob formed the fore-shore of the sluice, being part of the mud bank of the Eau Brink itself, reaching down to the bottom of its channel. When we examined the parts still standing on Monday evening the 6th October, it was not difficult to come to a decided conclusion as to what had been the train of circumstances upon which its giving way had depended. The sluice itself had not, in the first instance, given way, but the bank at one side of it. *The bank had subsided;* and, as was proved by the crevices still visible in the still moving material of the bank, it had gone inwards in subsiding towards the centre of the Eau Brink; in other words, it was a case of slippage of the sides in towards the centre of the main channel, just of the character that we referred to in the commencement of this article, as being one of the phenomena of every muddy channel in course of deepening itself.

It would be useless here, and especially so, unaided by drawings and photographs, to enter more minutely into the train of causation, ending in the slipping and subsidence of such a mass of the bank as enabled the next rising tide to "turn the flank" of the sluice, and begin the rush inland, that soon laid the sluice itself in ruins. The point we wish especially to call attention to, and that which will form the moral or deduction of this whole article, is, that the failure of the great Middle Level sluice was, as is proveable, an affair of *subsidence*, and that now the failure of the Marshland sluice is also one of *subsidence*, of quite a like character. From what do these subsidences arise? They do not and cannot *originate* in any defects in the structure of the sluices themselves. No sluices or other structures can stand up, if the ground slides away from under them. The subsidences prove that the Eau Brink cut (as well as was the great Middle Level drain, before the latter was dammed) is at this moment *in process of deepening itself*—that some great change has, within a recent period, taken place that has newly thrown its current *out of regimen*, and that the work we have at the commencement referred to of deepening and enlarging its channel, by sweeping away the mud of the bottom and sides, and by slipping in of the latter, is now in progress. With the slipping in and subsiding sides, the sluices based upon them, have been brought into movement also, and destroyed.

Let us trace down the Eau Brink to its mouth at King's Lynn, and we shall at once find the cause there, of all these Marshland disasters. Within the last two years a new channel, like that of the old Eau Brink, has been cut from the town of Lynn, right across the land in a northerly direction, and into the German Ocean at about 3 miles below the town, and the old channel of the River Ouse, by which, over flats and shoals, it spread itself into the sea, has been dried up by embankment, and is rapidly being raised by silting up.

The effect of this, new straight and already deep channel, which is in fact a great ship-canal for the harbour of King's Lynn, has been already *to lower the level of low water of spring tides there, from four to six feet below the lowest level at which they stood after the Eau Brink had been for years finished, but before this new channel at Lynn was opened.* Now, from Lynn to St. German's Bridge, about where these disasters have taken place, is about four miles only. The result, therefore, has been to increase the water surface slope, at low water on the Eau Brink for this distance at the rate of more than twelve inches to the mile.

With such a body of water as passes up and down the Eau Brink, and with such material as its channel is formed of, it is no wonder that a prodigious erosive scour and slipping in of sides towards the centre have been produced.

To the establishment of the new channel at Lynn then, we unhesitatingly ascribe all the disasters of the Fens of this year; and we venture further to predict, that at this moment there is no single sluice, opening into the Eau Brink, safe, nor indeed any point of its embankments, and we shall be by no means surprised to hear of further and even more serious accidents happening this winter.

It would be out of place here to enter into the measures that might, and as it seems to us, ought to be taken forthwith, to provide against and prevent their occurrence. We have no doubt such may be taken, and with effect, if rightly devised.

One reflection, in conclusion, we cannot avoid making. We know not whether any or what parties may be responsible for the damage that has resulted from the formation of this new channel at King's Lynn. Perhaps no one can be made amenable; nor have we one word to say against the new channel itself, which, in every sense, is a work of important improvement—improvement not only to Lynn harbour, but to the whole Fen country whose natural outlet is there. But this is one instance of many others that might be pointed out, some of which Mr. Telford, in his own memoir on the Fen country, has feelingly referred to, of the prodigious evils that result from the divided and subdivided authorities, interests, and responsibilities of this tract of England. It appears to us to prove that some new and wise legislation for it, is now imperatively called for, which, overriding all petty and local opposition, but not confounding or infringing private or local rights, should give to one grand Commission or Trust a wide and paramount control of all existing and of all future engineering works in the Fens. The result of such a control, wisely ordained, would be to cheapen all future improvements, reduce litigation, remove difficulties, and prevent any one improvement, small or great, being made without due consent and cognisance of its

consequences to other interests, distant perhaps in space, but in issue and result near neighbours.

A Water Administration exists, and with the happiest results, in Holland and in Germany. Some such central administrative body in the Fens, our English Holland, is needed. The preliminary to its establishment would be an efficient and comprehensive Commission of Inquiry and Parliamentary Report upon all the innumerable divided trusts and interests of the whole region. Many of those are grown grey and stiff with age, and as antiquated obstructions, are only worthy of being swept away; others might be subordinated and usefully placed under the control of the great presiding body, to form—The United Fen Administration.—Ed.

THE MECHANICAL INFLUENCE OF THE SUN UPON THE VEGETABLE KINGDOM.

BY J. ALEXANDER DAVIES.

That the heat of the sun expands vegetable substances, and various chemical effects are produced by its actinic rays, are facts concerning which men of science are agreed; but there is one very notable effect of the sun upon the vegetable kingdom, which has not, I think, been recorded, and which is a palpable instance of the solar attraction. I allude to the ramification of the various components of the vegetable universe—a mechanical effect of the most striking character.

It is a general observation that every tree and plant has what is called a fork, from which the branches commence, and many, undoubtedly, have observed that these, in every case, lie more or less in the same plane, or opposite; but the cause of this peculiarity of situation has not, I think, been explained, even by an hypothesis. The existence of a fork in trees and plants is produced by the smallness of their cohesive power, by virtue of which their several parts are pulled asunder by the solar energy, and thus branches are formed. The fork is the separation of the tree into two parts, which, in every example, are, more or less, in the same plane, or in opposite directions, a condition which I take to arise from the same cause that a nail, when it splits a piece of wood, always makes the divisions in somewhat opposite directions: a nail never makes the separations in a sound piece of wood at right angles, but, in every case, more or less in one plane; and, similarly, the branches of trees are invariably situated in directions somewhat opposite. The deviation is in many cases very considerable, but the observation of a number of instances taken at hazard, which attention any individual can give, in a railway carriage, a coach, a field, or a highway, is sufficient to convince any person that the law exists, and, from various causes in the several instances, oscillates between certain points. It is not easy to understand why the separation of a piece of wood by a pointed instrument is always effected in the way it is; it cannot be by virtue of the grain, inasmuch, as in woods having only a very imperfect grain, no difference in this particular is found, and the condition is experienced in substances having absolutely no grain, as sealing-wax and dry whitewash, when pierced by any instrument.

It may be concluded, supposing the substance experimented upon to be homogeneous, in which case alone it is certain that the separation would be as described, that the forces are principally distributed at the lines of separation, although, from our ignorance of the molecular arrangements of substances, the forces cannot at present be traced; and, as regards this phenomenon of growth, we may also, I think, conclude that the solar energy, which attracts, instead of repelling, as a nail does, is mostly distributed at the parts where the fork branches, and all the minor ramifications commence, acting upon the matter of the trunk, and the higher parts of the tree, in the opposite way to that action which a pointed instrument effects upon any substance which it is caused to pierce. This notable condition in vegetable ramification is a prodigious mechanical effect, and must be supposed to have an equally conspicuous cause, which cause I have here, by a theory, endeavoured to explain—a theory, inasmuch as the explanation is not, *as such*, assumed, the only suppositional part being its application, it being known to pertain to the illustration brought forward.

The influence of the solar attraction upon vegetation varies with the densities of the objects attracted, being greater in proportion to their smallness of density, and this on account of the terrestrial attraction, which, according to its degree, neutralises that of the sun: thus, trees and plants, I think I may affirm without exception, even as regards the members of any kind or species, are high according to the smallness of their density, and *vice versa*; and, similarly, all small shrubs, flowers, and vegetables, are elevated with this condition, and denser than the former mentioned objects, indeed, the densest components of vegetation—a circumstance which could, without trial, be concluded, from their especially succulent nature. As examples of this law, which, I think, I am the first to notice, and which, among other matters, was put forth a year or two ago, it will be of utility to compare the heights of the following trees with their densities, the former of which decrease, and the latter increase, regularly:—Poplar, 0·383; female fir, 0·498; male fir, 0·550; American cedar, 0·561; elm, 0·671; walnut, 0·681; elder, 0·695; apple tree, 0·793; ash, 0·845; olive, 0·927; lignum vitæ, 1·333; box, 1·328. In stating this condition to be without any exception, I of course premise two things, which are, that as regards soil and climate the plant is as favourably situated as possible, and that its altitude has not artificially been lowered. As an example of the latter mistake, it would, of course, be absurd to take a roadside elder-bush, which receives an annual cropping, as a specimen of an elder *tree*.

THE MAIN DRAINAGE WORKS OF LONDON.

The objects sought to be attained by those works were to intercept nearly fifty-two million gallons of sewage, which now empty themselves into the Thames, and, by means of covered channels, as far as practicable, to convey them to points in that river remote from the metropolis, viz., Barking Creek on the north side, and Erith Marshes on the south side. The works in progress were designed to give deep outfalls, and prevent in future the flooding of the low-lying districts in times of heavy rain. They were also intended to carry off not only the sewage, but the rain which washed the streets, except such heavy rains as occurred about twenty-four times in a year, on which occasions the old sewers would act as safety valves, and let off the surplus water into the river. The original estimate of the intercepting scheme was about £3,000,000, and, in spite of the rise in the price of bricks and other building materials, it was expected they would be completed for about that sum; but it would require another half-million to improve and cover the tributary sewers before the drainage of London could be pronounced as perfected. However desirable it might be, it was not possible to convey the whole of the sewage to the required level at the outfalls by gravitation, for a large portion of London which was densely inhabited was several feet below the level of high water in the river. For that reason the whole area on each side of the Thames, has been divided into three levels, and the sewage carried as far as practicable from two of the upper levels by gravitation; but the sewage from the low levels had to be raised by pumping, by which means the low districts would become as dry and as well drained as the upper districts, and the waters of the upper will no longer inundate the lower districts. The main drainage scheme was commenced in February, 1859; and out of the estimated £3,000,000, works to the amount of nearly £2,000,000 were now under contract, and most of them in a forward state and rapidly progressing. Those contracts embraced about fifty miles of main intercepting sewers, which were mostly under ground, but in some places they were above ground, crossing alternately under and over navigable rivers, railways, canals, and roads, and including pumping stations, aqueducts, penstocks, tideflaps, and other appliances. The northern high level sewer, which extended nine miles in length, from Hampstead to the River Lee, at Bow, formed a substitute for the open Hackney-brook and Fleet sewers, and was now entirely completed. The northern outfall sewer, which extended from the River Lee to the River Thames at Barking Reach, received the united streams of the high and middle level sewers at the Old Ford Penstock Chamber, and conveyed them, still by gravitation, through two large tunnels to Abbey Mills, where, by a pumping establishment, the low level sewerage would be raised to this high level, and thence the whole sewage of London north of the Thames would flow through three parallel channels to the outfall. This was the largest contract yet let, and, unlike others, the double and treble lines of sewers, would be above the ground, instead of under it. Those sewers are now in course of construction upon a raised bank of concrete, and they crossed by iron aqueducts over seven branches of the River Lee, and passed over and under several railways. The works are progressing rapidly, and the total value of the work done was about £93,000. The middle level sewer contract extended from Kensalgreen to the Penstock Chamber, at Old Ford Bow. It was 12½ miles in length, and varied from 4 ft. by 2 ft. 6 in. to 12 ft. by 9 ft. in diameter. Every arrangement has been made by the contractors to prevent inconvenience to the important thoroughfares through which it passed. The total value of the work executed under this contract is £63,000. The Ranelagh storm overflow is nearly completed, and the value of the work executed £22,000. The southern high level sewer embraced two lines, the one falling from Clapham to New Cross, and the other from Dulwich to New Cross, whence they have been constructed side by side in one trench, but at different levels, under the Brighton, North Kent, and North Woolwich Railways, and along the New-cross-road to the Broadway, Deptford. At Deptford Creek they discharge their storm waters through two sewers each eleven feet in diameter, and the sewage would be conveyed by four lines of iron pipes under the creek into the outfall sewer by gravitation. Between six and seven miles of sewers were now completed under contract, at an expenditure of £118,000. The southern outfall sewer will convey the sewage pumped into it from the low-level sewer and from the other sewers, through Greenwich, by tunnel one mile long,

Plate 293.

STEAMBOAT LANDIN

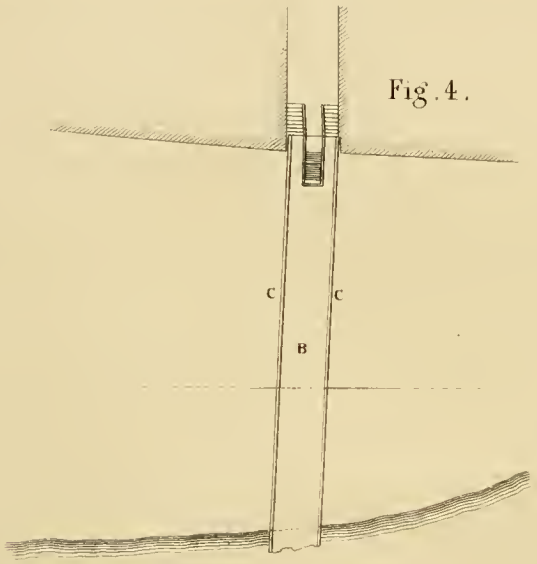
ERECTED AT A

THE CONSERVATORS

DESIGNED BY Mr S. LEACH, MES

Fig

Fig. 4.



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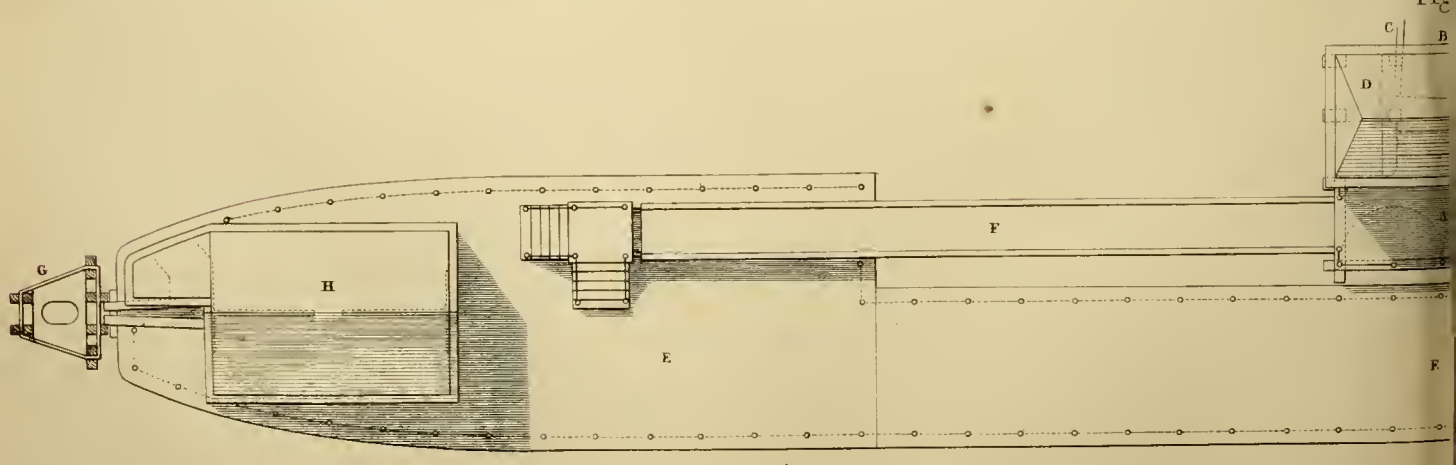

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STAGE AND PIER,

ALLOWS BY

THE RIVER THAMES.

RENNIE & SONS. ENGINEERS.

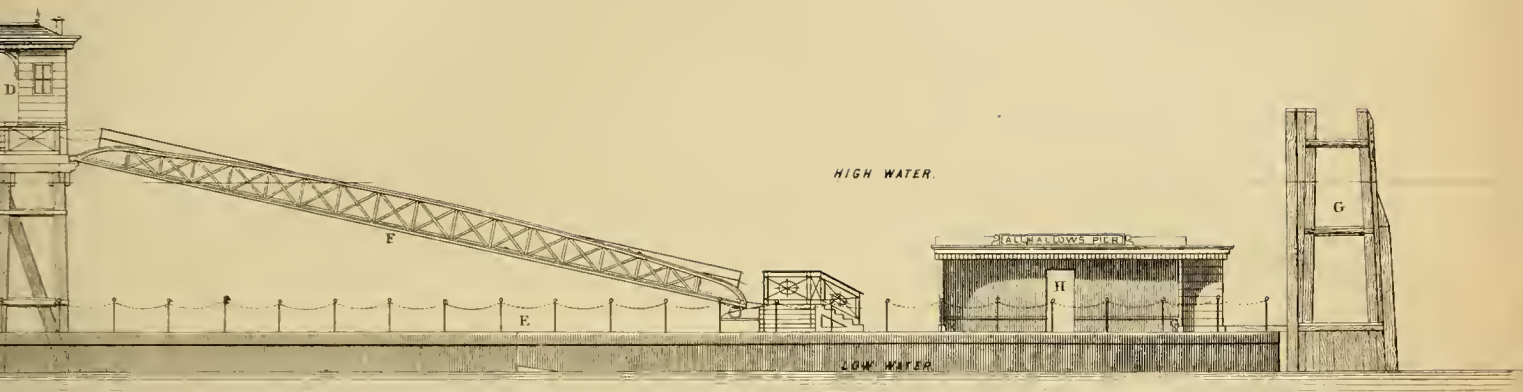
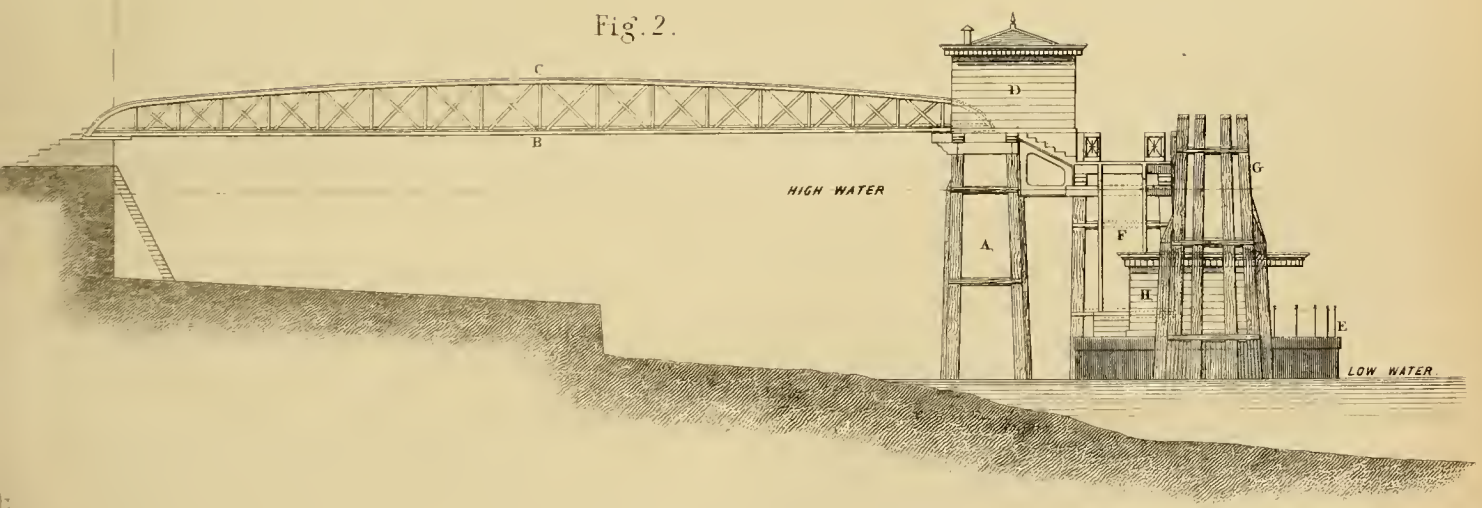
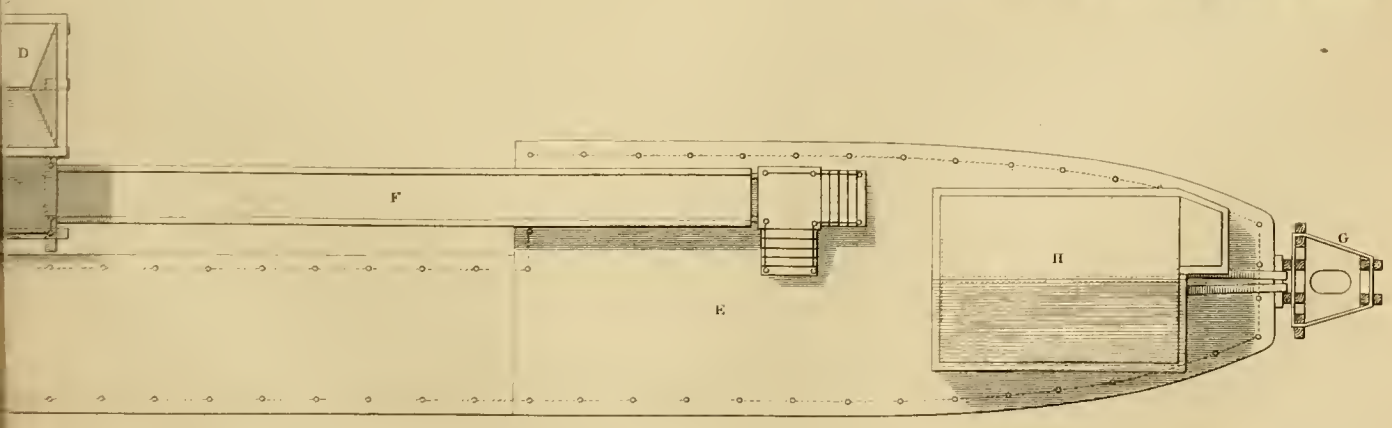


Fig. 2.





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STEAMBOAT LANDING STAGE AND PIER,

ERECTED AT ALLHALLOWS BY

THE CONSERVATORS OF THE RIVER THAMES.

DESIGNED BY Mr S. LEACH. MESSRS RENNIE & SONS, ENGINEERS.

Fig. 1.

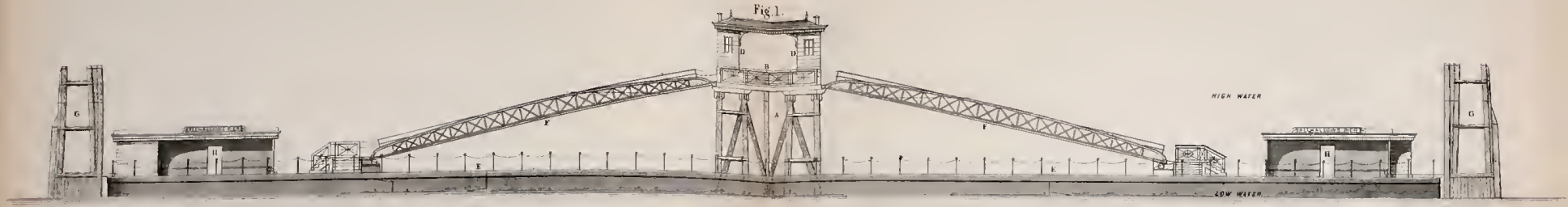


Fig. 4.

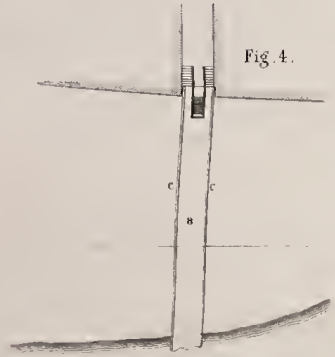


Fig. 2.

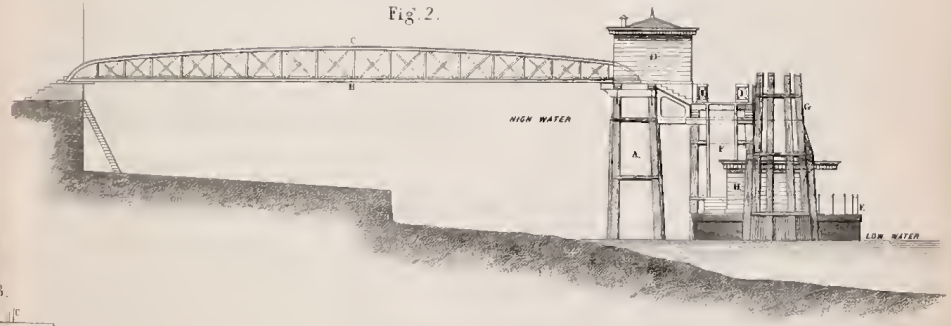
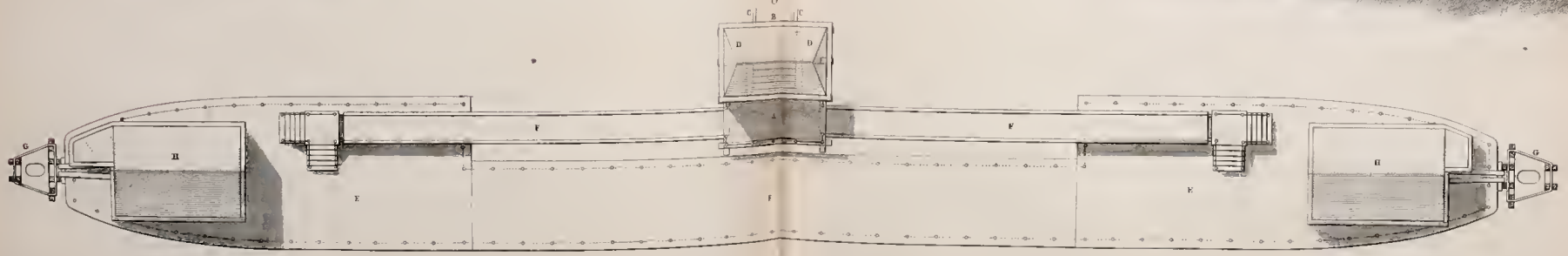
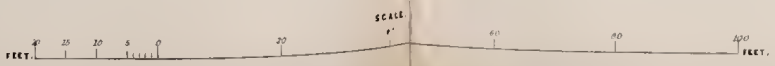


Fig. 3.





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under Woolwich, and on to Erith Marshes, to a pumping station at its outlet into the river. Of that work, about five miles, 11½ feet in diameter, including the Woolwich tunnel, has been completed, at an expenditure of £206,000. Up to the present time, nearly one million has been expended upon the works, purchase of land and incidentals. Mr Bazalgette, the engineer charged with these great works, is of opinion that they are proceeding satisfactorily, and that the main drainage scheme will be completed in a year or one year and a half.

SCHIELE'S TURBINES.

We have received a long letter from the North Moor Foundry Co., complaining of the remarks made as to Schiele's turbine, of which they are the manufacturers, in the article on water power, in the *Practical Mechanic's Journal Record* of the International Exhibition, 1862.

We regret that we must decline to publish that or any similar letters, and for two reasons:—We do not hold ourselves, as journalists, responsible for all statements made, as individuals, by the several authors of the articles of the *Exhibition Record*. We do not deem the pages of this *Journal* would be usefully employed in discussing opinions which, possibly unfavourable, in some cases, to particular objects exhibited, have, in every case, the guarantee of fairness and accuracy, that belong to the eminent men who constitute the authors of that *Record*.

In the present case, having read the letter of the North Moor Foundry Co. carefully, we are bound to say that it alters nothing of the opinions we had previously held as to the correctness of the statements with regard to Schiele's turbine, contained in the *Record;* and were we to depart from the principle we have laid down, as to all such communications referring to the *Record*, and publish their communication, we should have to accompany it with a refutation, which we willingly avoid.

We have no hostile feeling to these turbines, manufactured by the North Moor Foundry Co.; on the contrary, we willingly give insertion to the last paragraphs of their communication, and which they will probably deem sufficient for their purpose. We cannot, however, recur to this subject.—Ed.

"In conclusion, we will only say that Schiele's turbines have the good opinion of all *practical* men. They have been very extensively applied ever since they were brought before the public; and we have received the most flattering testimonials from those who have applied them in place of common water wheels, with a very considerable advantage.

"As a further proof of the efficiency of Schiele's turbines, we may add that we have now orders in hand for above twenty of them, of 130 horse-power each down, for falls of 200 feet down to 6 feet.—We are, sirs, yours very respectfully,

"The North Moor Foundry Co.

"*Oldham, October*, 1862."

FLOATING LANDING STAGES.

Illustrated by Plate 293.

Floating landing stages are of very old invention, although, at the time when the late Sir William Cubitt designed the first Liverpool landing stage, their history had been so little examined, or so much forgotten, that they were looked upon as new; and, indeed, the expansion he then gave them, entitled him to be viewed almost as a new inventor.

Whatever may have been done in those cradles of early navigation—the Persian Gulf and the Mediterranean—in more modern days, and amongst northern peoples, the floating landing stage seems to have been first due to the Dutch. We should be almost prepared to expect this, as their sandy and shoal-encumbered shores and harbours compelled some contrivance that should give to ships, while afloat, a firm foothold with the land, and yet obtain this without the requirement of any fixed substructure, whose connection with the bottom, by altering locally the regimen of tide or current, might eventuate in permanent injury by the disturbance. In fact, this is the real value of the floating landing stage, and one, the greatness, and the wide adaptability of which, are not even yet fully appreciated.

Some of the very oldest floating stages in Europe may still be seen in use, at Rotterdam, and other Dutch ports. They are nothing but short, broad, flat, or nearly flat, decked pontoon boats of timber, with pointed ends, from both of which they are anchored, out from the land, with which they are connected by a timber bridge, or more than one, resting upon the pontoon at one end, and rising and falling with it, and, at the other, upon the land. Landing stages, in almost every respect identical, are still in use at Waterford harbour, in Ireland, and have been so for more than a century. It is very probable that their introduction there was due to the American engineer, Cox, who constructed the large timber-piled bridge across the river Suir, at Waterford—a highly important work, considering the time and circumstances of its erection.

We believe, also, that floating stages of considerable antiquity are not unknown in Denmark, and at various points of the Baltic shores.

A small landing stage was constructed at Liverpool, nearly thirty years ago, by the late Mr Jessy Hartley, the engineer of the port. It consisted in a short, flat, timber pontoon, moored at both ends, and connected with the quay opposite, by a sort of bascule bridge; and at dead low water, and up to about quarter flood, by a very well-contrived rolling gangway, which, when withdrawn, was housed in an arched tunnel, formed through the base of the quay wall, and which was approached by inclined planes, or steps, at the landward end.

For a considerable time, the City of Dublin Company's steamers came alongside this stage, to land and embark passengers from or to Ireland. Its total length did not exceed, probably, 200 feet, and it was found quite inadequate to the rapidly-growing demands upon it; and, after a time, the Liverpool Harbour Trust offered a premium, by public advertisement, for the best design for a much larger stage, defining certain conditions which the designs must fulfil, but not limiting them otherwise. A large number of designs were, in due time, sent in, and the late Sir William Cubitt was appointed to decide upon their merits.

The upshot was, that Sir William, we believe, reported that the best design was comprised in a mere pen sketch, (or little more), contained in a letter, which suggested the application of the floating landing upon a large scale; his report added that he could not, unconditionally, approve of any of the designs sent in, and considered that a design better than any might yet be made. Sir William was thereupon commissioned to prepare such design, and, with the advantage of having had some hundreds of projects previously before him, he produced that which was, without needless delay, carried out, under his directions, and still floats, in front of the George's Baths, in the Mersey, under the name of the *old* landing stage. Another, of much larger size, but essentially the same in design, having been since constructed by Messrs Vernon, of Birkenhead, for the Harbour Trust, and moored off George's Pier Head, in the Mersey, and known as the *new* landing stage.

The first, or old one, is about one-half the size of the new; both present a nearly flat deck, of several hundred feet in length, and nearly one hundred in width, at about eight feet above the water line, and are formed of semi-cylindrical pontoons of boiler plate, placed parallel to each other, and crossways to the length of the deck, beneath which is a powerful system of longitudinal girders, of oak in the old, and mainly of boiler plate in the new, to connect the pontoons, and stiffen the deck. The latter is secured to these by a superimposed system of deck beams athwartships.

The method of mooring adopted is somewhat peculiar. The chain cables from both ends are not carried out forward and aft from the stage, as in ordinary ship moorings, but are carried back beneath the stage itself, so that the four main anchors are dropped close under what may be called the bows and the quarters of the stage; by this means the slack of the cables are almost wholly protected from becoming fouled by shipping by the cover of the stage itself. The construction in many separate cross pontoons, each capable of being withdrawn (while the stage is afloat and in use) for repair, &c., and this mode of mooring, are the main points of novelty in the construction of these fine works.

Both stages are approached from the land by hinged girder bridges, consisting of a roadway sustained by two box-girders. In the last constructed stage, a great error appears to have been committed in proportioning their length to the rise and fall with the tide, so that at dead low water the inclination of roadway is inconveniently steep.

Nothing can answer better than do these stages for the accommodation of the crowd of ferry-boats, and other steamboats of short passage, that constantly cluster round them, taking in or discharging passengers. Abundant roofed-in shelter is provided for persons waiting on the stage, capable of covering several hundreds; and at the rear or land side, and well out of sight, urinals are also provided for men; accommodation for women is found in a good waiting-room; and a refreshment room also exists upon the deck, and a tobacconist's shop at the other end There are also convenient means of getting into and landing from row-boats at the land side in smooth water.

In a word, the details for the comfortable use of the stage for its destined purpose have been fully and thoughtfully carried out.

The contrast is great between these Liverpool stages and the corresponding means provided upon our river Thames, for embarking and disembarking on and off our river steamboats. Steam navigation nearly thirty years ago gave the death blow to the "waterman and wherry" system of movement on the river of our forefathers. Its doom had come as soon as the first large steamer came up to London Bridge, and demonstrated, by the flap and agitation of her paddles, that thereafter open-boats risked being swamped at any moment.

With this the desire of more rapid communication on the water was

combined, and the arrangements by which the interests of the "watermen" were amalgamated with those of the new steamboat companies were greatly promoted by the yearly increasing pressure of wheel traffic on the great thoroughfares. The river boats once started were rapidly brought almost to what they present at this moment. One of their most indispensable adjuncts was the production of a succession of landing and embarking places at various points on the river, and for these, floating landing-stages formed the most obvious and the most readily-obtained resource.

Almost the whole of these were at first formed of old barges, decked over and moored in the stream, either between guide piles driven into the bed, or with chain moorings only, and approached by gangways, either resting on the land and on one or on several barges, or supported partly on piling.

The whole affair at each embarking place was rude, cumbrous, insufficient, and often dangerous, and fully bore out the propriety of the the undignified name of "Dummies" by which these floating stages were generally known. Several of these truly disgraceful make-shifts still exist, in all their primitive barbarism, upon the river. Those at Waterloo and Westminster Bridges may be regarded as typical specimens still surviving. Below London Bridge, several years ago, improvement began to arise, compelled by the greater size and momentum of the below-bridge river boats, by the formidable surge raised by the passing up and down of large sea-going steamers, and by the occasional sea in stormy weather in the Thames.

The floating pontoons moored alongside the east iron piled quay of Blackwall, and the Greenwich Pier of the late Mr Tierney Clarke's design, were amongst the earliest of these improvements. But above bridge extremely little has yet been done to substitute even respectable and safe landing-places for the "Dummies," which are certainly a disgrace to our metropolis, and must look supremely mean and ridiculous in the eyes of our orderly visitors of France, where public safety, decency, and comfort, as dependent upon the engineer and architect, do not wait upon the thrust of necessity or the force of some dire calamity, as with us, but are done well and in good time.

One remarkable example to the contrary, however, is the new pier of All-Hallows, which forms our plate for this month, and which has been very recently completed by Messrs. Rennie, as contractors for the iron work, of which the structure mainly is formed. It consists of a pier, A, run out from the north shore of the river a little below Southwark Bridge. This consists of piling united by diagonal and cross framing, and carries a gangway-platform, B, of greater breadth than usual, upon the level of the bottom web of the two wrought-iron latticed girders, C, at either side, which support it and form the hand-rails also.

This terminates at the river end in a tolerably large rectangular platform sustained on piling, and upon which are small offices, D, for the ticket distribution, &c. Along, in front of this staging, float the large and nearly rectangular iron and timber-decked pontoons, which form the landing stage, E. An inclined gangway, F, of less breadth, but generally similar in construction to the main one from the land, is hinged, one at either end of the central stage—the one looking up and the other down stream—and both resting at their lower ends upon the pontoon decks, with proper adjustments, of friction rollers, and rail guides, &c., to admit of free movement, as the pontoons rise and drop with the tide. The pontoons are kept in position by moorings, and by two large "dolphins," G, or systems of guide piles at each end—the central stage acting as part of this. Upon the deck, which is of considerable length, as will be observed by the plate, but, in our judgment, of insufficient width, there is some little shed accommodation, H, for passengers standing waiting for boats, but still such as is quite inadequate even to keep off wet—on a day of rain in winter, with the wind strong from the south and west, or south and east. Upon the whole, this landing stage is a great advance upon anything previously existing above London Bridge; much superior even to the recently erected landing piers near Battersea Park, but it leaves very much yet to be desired. What possible reason can be given why the millions of people carried to and fro upon the Thames by river boats, should not have the same sort, and goodness of accommodation as the Liverpool people enjoy upon the Mersey? There is not a landing-stage that should not have an ample deck—say, for first-class stopping places, 400 feet long by 50 feet wide at least; upon it should be ample waiting-rooms glazed all round; in each should be a refreshment bar, and a place for the sale of newspapers and periodicals, and an end should be summarily put to the abominable nuisance of boys and men rushing and dragging through the crowded decks of the boats, and worrying every one with their monotonous shouting of *News*, and *Punch*, &c. Why should the nuisance of selling papers on board be sanctioned, when the no greater nuisance of hawkers bringing their baskets on board is forbidden.

A shed, open in front, should exist for smokers, and for those bringing burdens with them, (as workmen and the like,) or fish, or such like; and a waiting room for women, and urinals for men, ought to be placed likewise. A drinking fountain in the smoking shed would be advantageous in summer.

In fine, a very little *mind* applied to these river landing stages, and the *will*, on the part of public authorities, would soon convert them, from dangerous and comfortless disgraces to London, as they all (with this exception, and, perhaps, one or two more) are, into what they ought to be, in the fullest degree that engineering skill can make them, public accommodations.

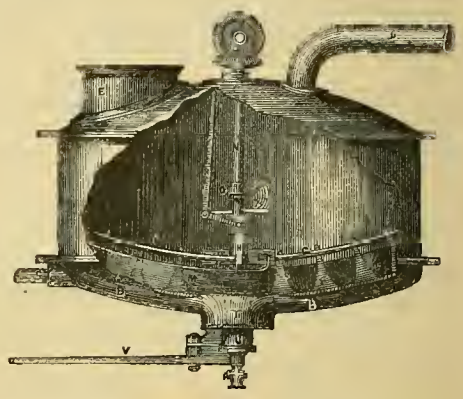
Nowhere is such a change more loudly called for than at London Bridge, upon the city side; and nowhere do existing circumstances, if duly taken advantage of, offer greater facilities to the engineer to construct there a floating landing stage of the most perfect description. It should extend quite up to the east end of Calvert's brewery, in one unbroken platform, and down to the upstream side of London Bridge, and be approached by the side steps of the latter, as well as by other avenues, and should extend out, in line nearly with the first pier on the city side.—Ed.

RECENT PATENTS.

TREATING WORTS.

G. D. Mertens, *Margate, Kent* (C. T. Authorn, *Saxony*)—*Patent dated April* 10, 1862.

This patent comprehends an improved system or mode of treating "worts," with a view to the solidification of the same, so that this preparation may be easily kept for any length of time in any climate, and be subsequently used when required for the manufacture of beer by simply dissolving in water. According to this invention, the "worts" are evaporated in a closed vacuum pan heated by steam heat, and having a suitable exhauster in connection therewith for the purposes of facilitating and expediting the process at a low temperature, so as to prevent any charring of the substance, and for the same object it is of the greatest importance that the substance under treatment be kept in constant agitation. The accompanying engraving represents a vertical section and partial elevation of a convenient mode of arranging the said apparatus. A is a vacuum pan, beneath the curved bottom of which is a steam chamber, B, supplied with steam from the pipe, C, and provided or not with pipes or cocks for carrying off the water of condensation. This steam chamber serves to heat the contents of the vacuum pan; and in order to further facilitate its evaporation at a low temperature, a pipe, D, opens into the top of the pan, and leads away to the air pump or other exhausting apparatus. The "worts" to be solidified are introduced through the filling aperture, E, which is provided with a moveable air-tight cover for that purpose, and during the whole period of evaporation the "worts" are subjected to a constant stirring action, by means of revolvings crapers or stirrers, in the form of pallets, as shown at F. These pallets are fixed in the arms, G, which are themselves carried by the short arms, H, of a boss, I. A second boss, K, also provided with arms, I, carries the two curved scoops or scrapers, M. The form of these scoops is such that whilst they rotate in the direction of the arrows, they tend to collect or scrape in the partially solidified "worts" towards the centre of the bottom of the vacuum pan; but as each curved scoop is succeeded by a set of inclined pallets, F, which are set in a radial line from the centre at their scraping edges, the result is, that the "worts" are forced out from the centre again, and spread over the surface of the pan, consequently, an effectual stirring or cogitation of the "worts" is obtained, so long as the stirrers are in action. The bosses, I, K, to which the two sets of stirrers are severally connected, are both carried by the lower extremity of a vertical shaft, N, which rotates in a bearing, O, inside the pan, and is supported at its upper end by a stuffing box, P, through which it passes, motion being imparted to it outside the pan by the bevel wheels at Q. The boss, I, which carries the set of scrapers, is capable of sliding vertically along a feather on the vertical shaft, and is connected to the fork of a clutch lever, R, centred at S, inside the pan, which lever enables the boss to be lifted, and the pallets, F, to be raised clear from the bottom of the pan. This is



effected when the "worts" are sufficiently solidified to be discharged, at which period the cover is removed from the man-hole, and the attendant, introducing his arm inside the pan, draws forward the lever, and so raises the pallets. The rotatory motion of the curved scrapers is still continued for a time (the boss, K, being fast on the lower end of the vertical shaft), and the result is that they gradually draw the entire contents of the pan towards the central discharging aperture, shown melted at T; and the slide valve and cock, U, having been previously opened by its lever, V, the "worts" now partly solidified are discharged through the aperture into a suitable receptacle placed beneath.

RAILWAY SLEEPERS AND CHAIRS.

MATTHEW A. MUIR and JAMES M'ILWHAM, *Glasgow.*—*Patent dated March* 14, 1862.

THIS invention relates firstly to an improved construction of cast metal sleepers and chairs, and secondly to a mode of fixing rails in chairs. Fig. 1 of the accompanying engravings is a sectional elevation of one modification of the improved combined sleeper and chair, and mode of fixing the rails therein; and fig. 2 is a plan corresponding to fig. 1, the sleeper being cast with an ordinary form of single or intermediate chair thereon. The sleeper may also be cast with long joint chairs, and also suitable for the suspended rail. Fig. 3 is an elevation, and fig. 4 a plan showing the new system of fixing rails in chairs of the ordinary kind, not cast in one with the sleeper. This is arranged according to the system in which the rail is suspended on the jaw of the chair by its upper flange, and does not touch the lower flange or surface of the chair. This system is equally applicable to the combined sleeper and chair, as shown in figs. 1 and 2.

Fig. 1.

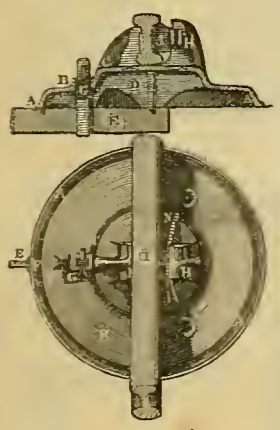


Fig. 2.

The form of this improved combined chair and sleeper, as delineated in figs. 1 and 2 of the accompany engravings, is the result of much consideration given to the subject, with the view of overcoming certain disadvantages attending the use of iron sleepers of the segmental spheroidal figure, and at the same time to attain the maximum degree of strength combined with the minimum consumption of metal. This combined sleeper and chair is somewhat in the form of a hollowed disc, with a raised boss or centre, on which the railway chair is cast. The lower margin of the chair, which rests upon the ground, forms a strong rim or beading at A; above this part the metal extends upwards in a conical form about two inches as shown. From the margin of this conical part the metal forms a disc slightly convex on the outer surface, as shown at B. This part extends inwards, and then rises in another conical step or figure, forming the slightly convex central boss, C, from which the jaws of the chair spring. The metal at this part of the sleeper is cast somewhat thicker to give increased strength to the crown, and extending below the central part; in a line with the tie bar is a transverse rib, D. This rib curves downwards from the outer part of the boss, and forms a central bearing, which rests on the tie bar when arranged in position. The metal of the rib, D, is curved out for the purpose of lightening the rib of an unnecessary amount of metal, and a second bearing surface is formed by the horizontal edge of the rib, near the inner part of the sleeper, where the rib merges into the lower conical part, at A. On the rib, D, at the central part, and immediately under the centre of the rail a feather is formed, which extends downwards a little below the bearing edge of the rib. The end of the feather fits into a notch made in the flat tie bar, E, so that the sleepers may be readily arranged at a corresponding distance asunder. The tie bar, when arranged in position, extends a little beyond the central bearing part of the rib, D, and at the inner part of the sleeper the tie bar passes through a small notch at F, which is formed by extending the metal at the margin a little below the rim. The tie bar, E, is secured to the sleeper by means of the saddle bolt, G, through the open part of which the bar is passed, the upper part of the bolt extending out through a slot formed for the purpose in the disc part, B, in front of the central boss, C, where it is secured by means of a split key. But in lieu of this arrangement the saddle bolt may be made round at the upper end, and screwed, so as to be fastened by a nut on the outside of the sleeper, or in any other equivalent manner. The jaws of the chair spring from the margin of the central boss, C. The inner jaw is formed in the usual way with a straight margin, upon or against which the upper head of the rail bears, the part below being recessed to receive the projecting part of the lower head of the rails, as shown in fig. 1. The outer jaw, H, of the chain is cast in a suitable manner to adapt it to the improved mode of fixing the rails. The inner face of this jaw, next the shoulder of the rail, is formed with a convex curved recess immediately under the upper edge of the jaw, to receive a curved or segmental split key, which will be presently referred to. According to one modification, shown in figs. 3 and 4 of the accompanying engravings, the ordinary single chair is arranged upon the hanging rail principle, that is, resting or bedded on its upper flange, but which may also be made broad for joint chairs, for securing the abutting ends of two rails, either for single chairs or for combined sleepers and chairs. The rail, I, is supported by the shoulders of the upper flange, resting on the upper surface of the inner jaw of the chair, and by the top edge of the bolster piece, J, arranged on the outer or opposite side between the inner surface of the jaw, H, and the rail. The form of this bolster piece, J, is shown in end view and plan in figs. 3 and 4. In transverse vertical section its form approximates a rectangular figure, its upper surface, at K, being rounded to correspond to the shoulder of the rail, whilst the lower edge, at L, is flattened to fit the flat part of the sole, the inner surface at this part presses against the lower flange of the rail. Above the lower part, L, the bolster piece, J, projects in a lateral direction, at M, the face of this part being recessed at the centre, whilst the end surfaces are formed to a convex curvature corresponding to the inner face of the jaw, H, the two surfaces thus form a tapered segmental channel or recess corresponding to the shape of the key. The bolster piece, J, is firmly secured by driving in the malleable iron key, N, which being curved to correspond to the contiguous nearly concentric surfaces of the bolster piece, and the outer jaw of the chair, and tapered towards the split end, so that when the key is driven in its lower edge rests partly on the recessed part formed at O, in the bolster piece, J, by which it is upheld, it is at the same time prevented from shifting in an upward direction by the overhanging part, P, of the jaw, H. The several parts of the arrangement are distinctly shown in the two enlarged views, figs. 3 and 4. When the key, S, is driven home it bears against the opposite concentric surfaces formed on the bolster piece and jaw, and an exceedingly firm and stable fixing of the parts is effected. The two bearing surfaces, M, of the bolster piece which are in contact with the key act like a double wedge upon it, the direction of the inclined surfaces tending towards each other. In this way the motion of the trains in either direction cannot disturb the solidity of the permanent way, for the force which would under ordinary circumstances tend to loosen the key in one direction is counteracted by the secondary bearing surfaces acting in the opposite way. So that however great the vibration may be to which the rails are exposed from the frequent passage of trains passing over them, the rails will yet remain perfectly firm and secure, as the mechanical construction of the fastening renders it impossible for it to become loose. The arrangement of the bolster piece also provides the means of adjustment to suit any little variation in the width between the jaws of the chair or in the thickness of the several parts, arising from wear and tear or other causes. It being a geometrical property of two concentric lines, that if they are moved in the direction of their tangent, the opening between them may be varied from a parallel to an acute or obtuse angled segment; it follows that any variation in the parts may be compensated for by moving the bolster piece slightly to the right or left in the chair so as to narrow or enlarge the opening for the key. The arrangement of the bolster piece, J, and key, N, is modified, as shown in figs. 1 and 2, as applied to the combined sleeper and chair, having the rail bedded on its lower flange in the usual way; the corres-

Fig. 3.

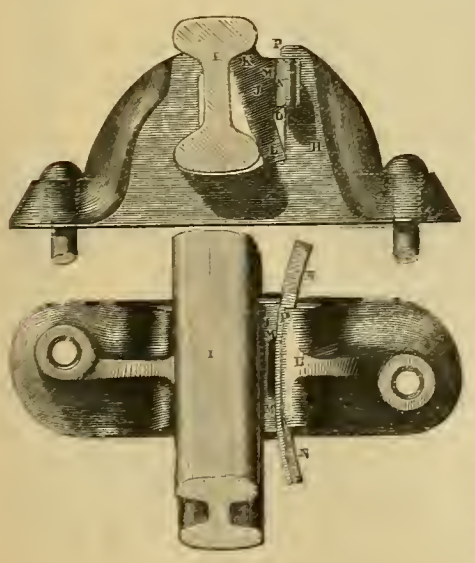


Fig. 4.

ponding parts being all marked by similar letters of reference as in the enlarged views, will be understood with little further description. In figs. 1 and 2, the improved sleeper and chair arrangement is shown with the rail, I, bearing on the sole of the chair in the usual way. The holster piece, J, in this modification, is a block of metal cast to fit the web between the upper and lower flanges of the rail; the inner face of the bolster piece in this case is recessed out, so that a narrow-fitting slip or rim round the margin of the face forms the bearing surface. The outer face next the jaw, H, is curved or inclined similar to the modification shown in figs. 3 and 4, and the mode of fastening by means of the split key, N, is in all respects the same. These sleepers and chairs, moreover, possess a much greater degree of strength than others, at the same time a smaller amount of metal is employed in their construction.

REAPING MACHINE.

James Hunter and Robert Scott, *Coltness.—Patent dated March* 15, 1862.

This invention relates to the arrangement and construction of reaping machines of the direct acting class. It consists of improvements in the general form and construction of the machine as a whole, but principally in having a double set of knives or cutters, and in the mechanism and system of applying and obtaining the power for driving these cutters. Rapid motion being simply and directly applied to them without the intervention of multiplying wheel gear, so that the number of parts and amount of friction, with the consequent liability to breakage and derangement, is much reduced.

Fig. 1 is a side or end elevation of a reaping or mowing machine arranged according to these improvements, showing the greater part of the actuating mechanism. Fig. 2 is a plan of the same machine, corresponding to fig. 1. The principal frame, A, of the machine is, by preference, formed of malleable iron plates, bolted together in an open rectangular figure. In this open frame, A, the axle, B, on which the main driving wheel, C, is keyed, is arranged to run loosely in cast iron bearings bolted to the sides of the frame; the wheel, C, is made with a broad tyre, which nearly fills up the open space of the frame, A. The front part of the rectangular frame, A, has also bolted to it the vertical plate, D, which extends outwards in an angular direction as a stay to the prolongation of the outer side plate of the frame, A, which is carried loosely on the journals of the axle, B. To this axle is also jointed loosely, between the wheel, C, and the inside of the frame, the two ribs, E, which are connected together by transverse stays and nuts, forming a frame, in the outer end of which is carried a swivelling bracket piece, F; in the bent forked ends of this bracket piece is carried the front bearing or guide wheel, G. To the upper part of the piece, F, is fitted a swivel and hook for attaching one or a pair of horses to the machine. Motion is communicated to the cutters of the machine from the main axle, B, on which is carried the wheel, H, the periphery of this wheel being notched or indented, as shown more particularly in fig. 1 at H^1, of the accompanying engravings. As this wheel rotates it gives motion to a horizontal sliding frame or bar, I. This part consists of two parallel side plates arranged on each side of the wheel, H. These plates are bolted to solid end pieces, which terminate in cylindrical prolongations that work to and fro in the guides, J. These guides are bolted to the side of the frame, A, and extend above it, level with the ends of the sliding frame, I, so that it works easily to and fro therein. Inside the cheek plates of the sliding frame, I, are fitted two antifriction rollers, K, which are carried on spindles fitted in bushes at the ends of the side plates. As the wheel, H, rotates, the projecting parts of its periphery press against the rollers, K, alternately, and so cause the sliding frame, I, to move backwards and forwards with great rapidity. An arrangement is also provided to prevent the sliding frame, I, from traversing to and fro excepting when employed in reaping or mowing. On the upper part of the front guide, J, is a small standard which supports the hand lever, L; this lever is connected by a link, M, to the wedge piece, N. When the hand lever, L, is depressed by the attendant, the wedge piece, N, is raised, and this admits of the bush in which the front antifriction roller, K, is fitted, sliding forward so that the wheel, H, is free to rotate without affecting the position of the sliding bar, I. A simple upward movement of the lever, L, causes the wedge piece to descend, and the horizontal reciprocatory movement is instantly imparted to the frame, I, and by its means to the cutters. The corrugated periphery or indentions, H^1, of the wheel, H, may also be arranged so as to impart motion from the inner edge of the rim or indented part of the wheel. This corrugated or indented part may also, if preferred, be fitted on either face of the wheel, or in any other convenient manner equivalent thereto. To the front extremity of the sliding frame, I, is keyed a cross head, O, to the lateral extremities of which are jointed the links, P and Q; these links are connected by the cranks, R and S, to the small vertical shafts, T and U, which are carried in bushes bolted to the fore part of the framing, A. The lower part of the shafts, T and U, are connected by the levers, V and W, and the connecting rods, X and Y, to the two serrated cutters, Z and *a*. These cutters consist of two series of teeth of the ordinary kind affixed to the rods, Z and *a*, which traverse to and fro in the guides, *b*, which extend out from the strong bar of iron in front of the platform, *c*, of the machine. The cutters are arranged with their inner faces in contact, or nearly so, and as they are caused to move in opposite directions alternately, their edges act in the manner of scissors in shearing the crop as the machine is caused to advance. To the strong bar

Fig. 1.

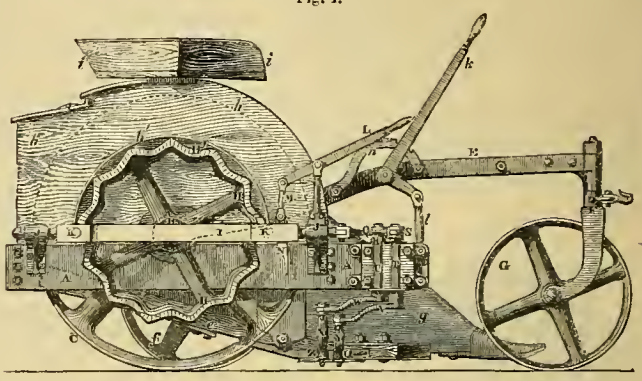
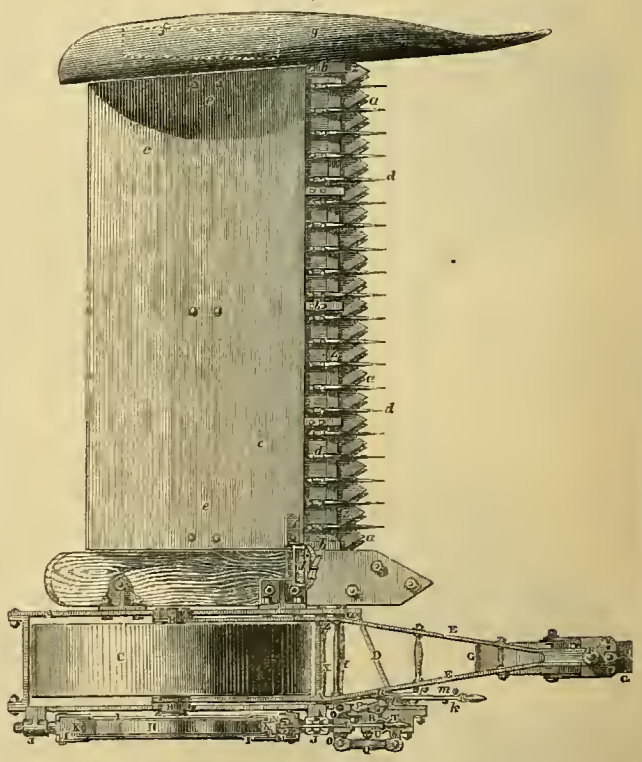


Fig. 2



extending across the machine in front of the platform, *c*, are also fixed the projecting fingers, *d*, which extend out beyond the points of the cutters, and beneath them, so as to form a kind of guard thereto. The platform, *c*, is arranged so as to oscillate on the spindle at *e*, which extends over to the opposite side or end frame *g*, of the machine. To the framing at this part is fixed a stud, on which is carried the outer bearing wheel, *f*, and to the framing is fitted the side, *g*, which extends out over this wheel. The driving wheel and its connected parts are enclosed by a casing, *h*, seen only in fig. 1, and on the upper part of this casing is arranged the seat, *i*, for the attendant. When seated on the machine one foot is placed in the strap, *j*, attached to the platform, *c*, and as he rakes the cut crop towards him from the opposite side of the machine, he causes the platform, *c*, to tilt backwards on the spindle at *e*, by lifting his foot at intervals, as the grain accumulates in sufficient quantity, and deposits it in

bundles ready for binding into sheaves. The main frame and bar with the cutters are adjusted to the proper height from the ground as required, by means of the bent lever, *k*, which is centred on a stud in the framing, E, and is connected by a link, *l*, to the front part of the framing, A. The hand lever, *k*, is fitted with a detent, *m*, the lower end of which takes into the notches of the segmental catch piece, *n*. By moving the hand lever, *k*, backwards, after lifting the detent out of the retaining notch, the front part of the machine is raised to a corresponding extent so that the cutters operate at a greater distance from the ground, and in this way the machine may be adjusted to suit various kinds of crops, or irregularities in surface of the ground. The machine may also be arranged to work if preferred with a single knife or cutter, acting against the stationary fingers, *d*, in lieu of the arrangement of duplex cutters shown and described. With these several improvements the reciprocatory movement of the cutters or cutter is obtained in a simple and highly effective manner, and the general operation of the reaping machine greatly improved.

WINDOW PULLEYS AND WEIGHTS.

WILLIAM M'ADAM.—*Patent dated March* 15, 1862.

THIS invention relates to the application of clay, or other suitable mineral substance, either in the form of earthenware or glass, to the manufacture of blocks, pulleys, and weights, and which have hitherto been manufactured of metal. Under one modification of these improvements, as applied to the hanging of window sashes, the block or frame in which the pulley or pulleys run is formed of clay moulded to the required form, and afterwards glazed and fired in the usual way. The sheaves or pulleys are also formed of similar materials, and various kinds of clay, such as are used in the manufacture of porcelain and all kinds of earthenware, may be employed. Instead of using iron or other metal for weights, it is preferred to make them of the heavier kinds of earthenware. These weights are either moulded solid, or with an internal cavity to be filled with "mine dust," or other suitable mineral material, or which may be mixed with the clay, for the purpose of increasing the specific gravity of the weights. Other mineral substances, such as stone of various kinds, the cheaper varieties of marble, may also, in some cases, be employed with advantage in the manufacture of these weights, or they may be made of glass, if preferred. In applying them to window sashes, or other generally similar sliding or moving details, it is preferred to operate both sashes with a single weight and line, in lieu of the ordinary system of a weight and line to each sash.

Fig. 1.

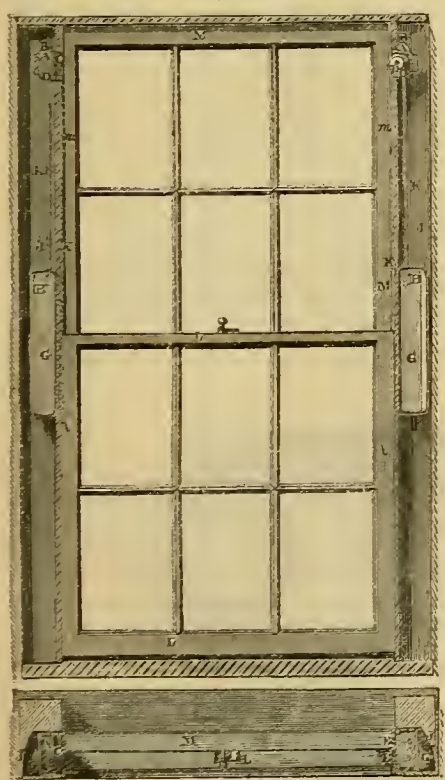


Fig. 2.

Fig. 1 of the accompanying engravings is an inside elevation, partly in section, of a window, showing one arrangement, or mode of fitting the pulleys and weights to an ordinary double sash window; and fig. 2 is a transverse sectional plan of the same. Fig. 3 is an elevation showing another mode of applying the pulleys and weight to two pairs of sashes of unequal size, the windows having a central mullion. Fig. 4 is an elevation showing two modes of suspending a single pair of unequal-sized sashes, in accordance with this invention. Figs. 5 and 6 are an elevation and plan of one form of the improved double sheaved pulleys, made for being inserted from the front part of the window casing. Figs. 7 and 8 are an elevation and plan of one of the improved weights for balancing window sashes. Referring to the improved pulleys for window sashes, and other generally similar purposes, the form shown, as applied in figs. 1 and 2, is adapted for that class of windows in which the pulleys are entered or placed in their proper position from the back part of the frame or casing which surrounds the sashes. The pulley consists of a box or frame, A, formed, by preference, of earthenware, which is moulded, glazed, or not, and fired in the usual manner. This box is made with a cheek, or enlarged rim, at B, extending round three of the sides; the front of the box, at C, extends out beyond the enlarged part, and carries the spindles, D, of the pulleys, E, which run in deep slots, extending to the back of the box, A. The pulleys, E, are formed like the box, A, of earthenware, and they may be glazed, or not, according to the style in which it is desired to produce the article. The pulleys, E, E, may be carried either on metal spindles, or these spindles may be formed of earthenware, moulded, and arranged in the box before firing, so that the parts of the spindles which enter the sides of the box are burnt together, and form one solid body. For particular purposes, these pulleys may be wholly, or in part, formed of china clay, or the sheaves may be made of glass; preference is, however, given to earthenware, as being cheaper, more durable, and the materials best adapted for the purpose. The arrangement shown, as applied in fig. 3, and in enlarged elevation and plans, figs. 5 and 6, is a two-sheaved pulley, intended to be entered from the front of the frame or casing, and secured by two long pins or screws passing through the holes, F, in a lateral direction; single-sheaved pulleys are also made on the same principle. Another modification is shown, as applied in fig. 4, the box, A, being arranged for a single pulley, E; this pulley is made to be screwed to and fitted in its place from the front or outer part of the frame or casing, which is the mode generally preferred by architects and builders. A flange is formed at the top and bottom of the box, A, in which the screw holes, F, are formed for fixing the pulley to the casing. In making the weights for window sashes, it is preferred to use the heaviest kinds of vitrified earthenware for the purpose. The form of weight, shown in figs. 7 and 8, is adapted for stone buildings, where there is generally a sufficient space left to receive a weight of the triangular figure there shown. The rectangular form shown, as applied in the central part of fig. 3, is, however, adapted for brick and other buildings, where the space is more limited; these weights may, however, be made of any shape to suit the particular purpose required. The weights, G, are made with a vertical slot at the upper part to receive the pulley, H, which is carried on a metal or vitrified earthenware spindle, I. In fig. 1 is shown one system or mode of applying these improved weights and pulleys to the hanging of window sashes, in such manner as to dispense with two of the weights as ordinarily employed. The frame or casing, J, of the window is fitted with a two-sheaved pulley, A, on each side; these pulleys are of the double-sheaved class, as inserted from the inside as already described. The cord, K, is attached to the lower sash, L, at or about the part marked *l*, and is carried up over one of the sheaves of the pulley, or sheave box, A, then downwards and under the pulley, H, in the weight, G, up over the second sheave of the box, A, and finally, is fastened to the upper sash, M, at *m*, or other suitable point. With this arrangement, the sashes work very easily with a single weight on each side; and from the peculiar mode of hanging the weights they only travel through half the vertical distance, as compared with the usual mode of hanging. The new arrangement affords great

Fig. 3.

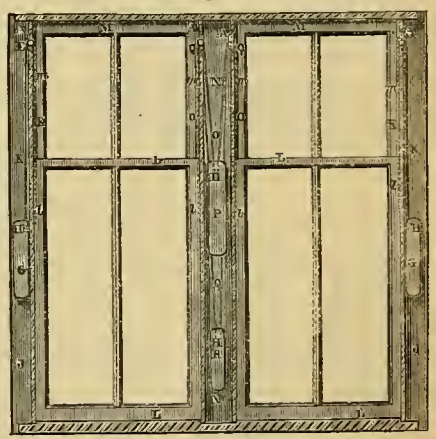
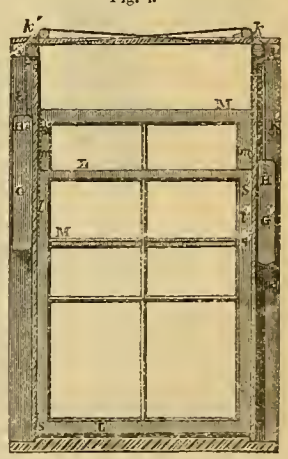


Fig. 4.



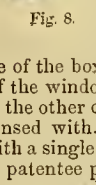
facility for hanging plate glass and other heavy windows where the space is small in proportion to the height of the windows, and as the weights and pulleys are formed of an incorrodible material no inconvenience can possibly arise from rusting, which so rapidly takes place in manufacturing towns, and in places by the sea coast. In fig. 3 is shown the mode of arranging the weights for sashes of unequal sizes, and where there is only space at the sides for a single weight. The pulley-boxes, A, arranged at the upper part of the frame or casing, J, are similiar to those delineated to enlarged sizes in figs. 5 and 6, and are inserted from the outside of the frames; and the arrangement of the cords, K, and their connection to the weights, G, and the sashes, L and M, are the same as before described in reference to fig. 1. The two weights, G, are, however, not sufficient to overcome the gravity of the sashes, and the additional weights are therefore arranged in a recess, N, behiud the central mullion. One end of the cord, O, is attached at *l*, to the lower sash, L, on the one side, carried up over one sheave of the pulley hox, A^1, downwards under the pulley in the rectangular central weigbt, P, then upwards over the pulley of the other window, and down to its lower sash, to which it is fastened. The weight, P, is sufficiently large to compensate for the deficiency of the weights, G, and the two lower sashes can thus be operated with great ease. The top sashes, M, have the cord, Q, connected to them at *m*, and passed under the pulley in the rectangular weight, R, which hangs in a plane behind the weight, P, so that, as they are of a flat rectangular section, they pass each other freely, and in this way both sashes work with equal ease and freedom. In fig. 4 there is two arrangements shown of hanging two unequal sashes by means of a single weight on each side; in the first the cord, K, is attached at *l*, to the lower sash, L, carried up over the single sheave pulley, A, and fastened by a piu to the weight, G, which is equal to the whole weight of the lower sash, L. To counteract the tilting of the sash hy the hanging of the weight on one side, small antifriction rollers, S, are fitted at the lower and upper corners of the sash, so that with this addition it runs quite easily. The upper sash, M, is fitted in like manner, the cord, K^1, being connected to the weight, G^1, which is made equal to the weight of the upper sash, and the friction of the sash is overcome by the rollers, S^1, the weights being duly proportioned to their respective sashes, makes a good working window. In the second arrangement, illustrated by the same figure, two unequal sized sashes are also hung hy a single weigbt on each side, as just described in relation to the first arrangement of this figure, but with this difference, that the cords, K and K^1, are double instead of single, the extra cord in each case. Thus the cord, K, of the lower sash, L, carried up over one sheave in the pulley-hox, down to the weight, G, where it is fixed or carried under a pulley at H, and then up over a second pulley in the hox, A, and across the top of the window over the pulley, *k*, on the opposite side, down to the other corner of the sash, L, at l^1, where it is fastened. The other cord, K^1, is carried in the opposite direction, so as to connect the upper sash, M, in the same manner with the weight, O^1. One end of the double cord, K^1, from the weight, G^1, being carried over the first sheave of the box, A^1, and attached at *m*, and the other carried across the top of the window frame down over the pulley, k^1 to m^1, where it is attached to the other corner of the sash, M; the pulleys, S, being, in this case, dispensed with. Two unequal sashes are thus hung in an even manner with a single weight each, and yet slide easily up and down.

Fig. 5.

Fig. 7.

Fig. 6.

Fig. 8.



Although the patentee prefers to manufacture these improved weights of vitrified earthenware when used for the purpose of hanging sashes, yet he does not confine himself solely to that material, as in some cases it may be preferable to use glass, porcelain, earthenware, various kinds of clay, or clay mixed with waste materials, or materials not available for other profitable uses. So also in some cases slag, iron pyrites, asphalte, pitch, and other similar materials used in combination with forge, furnace, and other slags, broken earthenware or glass, granite, quartz, ironstone, and other suitable mineral substances. These weights may also be made with an outer shell or casing, formed of earthenware, metal, wood, or other suitable material, and with the interior filled with any of the materials before enumerated, best adapted for the object in view. These weights may also be ornamented in various ways externally, where such is desirable, and they may be applied to a variety of useful purposes, as, for example, weights for shutters, doors, machinery, gasaliers, clocks, timekeepers, and other uses.

REGULATING THE FLOW OF FLUIDS.

JOHN & WILLIAM WEEMS, *Engineers, Johnstone.—Patent dated March 17, 1862.*

THIS invention has reference to improvements in apparatus for regulating the discharge of fluids. The collecting of air and water in cylinders and steam pipes has always been a source of difficulty and annoyance to engineers. The improvements which the Messrs Weems have introduced completely remedy the evil. One of the patentees' arrangements for removing the water of condensation from the cylinders of steam engines, steam hammers, and other similar machines, is delineated in the accompanying engraving, fig. 1, which is a vertical section, showing an arrangement of very general application. It consists of a valve case, A, within which is arranged a conical or face valve, B, opening upwards. This valve, B, is fitted with a long spindle, C, on which is placed a spiral or other spring, D. The valve case, A, is divided by a steam tight partition, E, so that the upward opening part of the valve is under the pressure, whilst the lower part is open to the atmosphere. The spindle, C, of the valve is guided and retained in its proper position in the barrel by the screw cap, F, and the spring, D, rests on the feathers of the valve or on a circular plate or collar, the other end bearing on the screw cap, F, so that the pressure on the spring tending to keep the valve open is regulated by the cap, F, which is fixed, liquid tight, by the jam nut, G. When the piston of an engine is receiving the steam in its forward motion the pressure, as indicated by the arrow, shuts down the valve, B, and when exhausting, the spriug, D, opens the valve, and the water is thereby discharged. The valve may be actuated by means of springs or levers and weights, by its own gravity, or by a mechanical motion in connection with the engine. The screw plug or cap, G^1, affords ready means of access to the valve, B, for cleaning or repairing. In some cases we prefer to arrange the apparatus in the reverse position, that is to say, with the valve opening downwards, the spring, D, acting on the cap, F, in an upward direction: this arrangement is found to be particularly suitable in certain applications. This apparatus also forms an excellent self-closing gauge cock by simply prolonging the spindle, C, out beyond a stuffing box, and fitting the prolongation with a knob, the spring, D, being dispensed with. The pressure of the fluid keeps the valve close to its seat, but on pressing iu the knob it escapes out through the outlet passage. Another arrangement for discharging the water of condensation, consists of a brass or other metal valve chamber formed in two parts and screwed together by flanges. Between the upper and lower halves of the chamber, is fitted an elastic diaphragm, which is connected to the spindle of the valve; this valve is pressed upwards by a spiral spring, as in the former modification, and regulated by the screw cap in the lower part of the valve chamber;

Fig. 1.

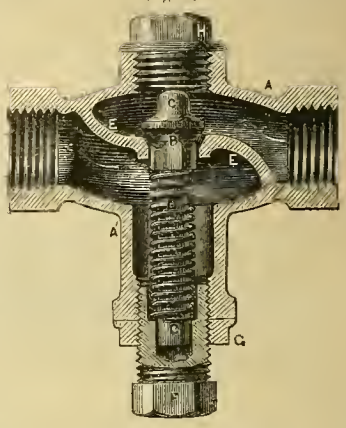
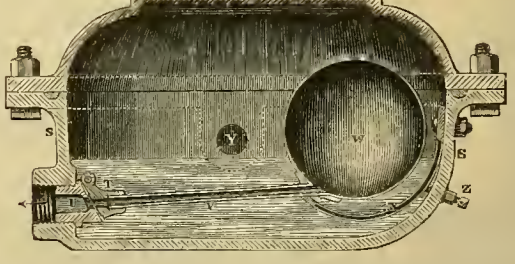


Fig. 2.



by screwing this cap inwards the pressure of the spring may he regulated with the greatest nicety. An opening is made through this cap so that the area of the elastic diaphragm—which divides the lower chamber of the valve box into two liquid tight divisions—is always exposed to the atmospheric pressure on the lower side. The upper part of the valve chamber forms a separate chamber into which the steam and water passage opens laterally, and into the perpendicular part of this portion of the chamber is fitted the valve, and leading to the outlet passage,

which is separated from the inlet chamber by a vertical partition at its inner extremity. This arrangement is particularly adapted for steam engines where the exhaust steam is employed at various pressures, the area of the diaphragm being much larger than that of the valve, shuts the latter against the pressure of the atmosphere, and that of the spring acting on the lower side of the diaphragm, so that the water of condensation is discharged in this way from the cylinder of the engine, without affecting or causing a variation of the pressure of the steam on the piston of the engine, or exhaust and adjusts itself to any variation of pressure. The general arrangement of these air and water dischargers may be variously modified to suit particular applications, without departing from the peculiar features of their construction. Another mode of removing air and water from steam pipes, engines, &c., while maintaining a uniform pressure, is shown in figure 2 of the accompanying engravings, which is a longitudinal section of the apparatus. It consists of a steam tight case or vessel, s, formed in two parts, which are bolted together at the flanges, and have a stuffing or joint packing arranged between the faces. At one end of the lower part of the chamber is fitted a face valve, T; this valve forms a hinged cover closing the port, U, which opens to the atmosphere. To this face valve is screwed a tube, V, the joint being made steam tight. To the end of the tube, V, is attached a hollow ball or float, W; and a free communication with the interior of the float and the atmosphere is thus obtained by means of the aperture through the cover of the valve, T, whilst the back part of the valve, subjected to the steam pressure, is kept tight. A flat or other suitably shaped expansion tube, X, by preference hermetically sealed at both ends, and of a curved or other figure, is secured at one end to the vessel, s, by a bolt and nut; the other extremity bears on the under side of the float tube, V. In lieu of this arrangement, the expansion tube may be connected by means of a lever, or made to bear on, or be connected to, any part of the float or tube, or it may be attached to an independent valve. This tube, X, expands with the heat, and contracts upon the temperature being reduced; consequently when the vessel is cold, the expansion tube is so arranged that the valve is kept open. On the introduction of steam into the vessel, s, through the inlet passage, Y, the air is discharged, and on the tube, X, becoming heated it straightens, and allows the valve, T, to close; and as the water of condensation accumulates, it raises the float, W, which opens the valve, T, and the water is discharged through the port, U; the float, W, then falls, and closes the valve. The inconvenience caused by floats getting filled with water, and collapsing, are by means of this arrangement overcome, for, as the water collects in the interior, a free passage is afforded for its escape down the inclined tube, V, and out through the open port in the cover of the valve, thereby preventing any derangement of its action. A screw, Z, is entered through the vessel, s, and fitted with a jam nut; this screw bears against the expansion tube, X, by which means the pressure of the tube against the tubular arm, V, of the float, W, may be adjusted with great accuracy from the outside. This arrangment of hollow lever float is also applicable to ball, clack, conical or other valves. The expansion tube may in some cases be with advantage partially or wholly filled with gaseous or liquid bodies, and may be made applicable to the purpose of regulating dampers or valvular apparatus for maintaining a uniform temperature in hot-houses, buildings, and vessels, and other generally similar purposes. The expansion tube may also be modified and arranged with a single valve for effectually discharging fluids. In fig. 3 of the accompanying engravings, is shown an elevation partly in section of a self-acting apparatus for regulating the dampers of furnaces. The pipe, *a*, leads from the steam or water space of the boiler, the steam presses on the surface of the water, or other suitable fluid, contained therein, up to about the level of the line, 1, 2. The pipe, *a*, communicates with the chamber, *b*, which has fitted between its upper and lower parts the flexible diaphragm, *c*, on which the disc, *d*, bears. The spindle of the disc extends out through the upper part of the chamber, *b*, and has bearing upon it the lever, *e*, which is furnished with an adjustable weight, e^1, to the standard, *f*, of which is fixed the curved spring, *g*, pressing on the lever. The lever, *e*, is connected by a rod, *h*, to the vertical rack, *i*, which gives motion to the pinion, *j*, on the axle of the pulley, *k*. An anti-friction guide roller, *l*, presses against the back of the rack, *i*, and keeps it in proper working gear. A weighted chain, *m*, is passed over the pulley, *k*, and is connected to the damper, *n*. An increase of steam pressure beyond what is required causes the fluid to raise the diaphragm, *c*, which, through the disc, *d*, lifts the lever, *e*, and lowers the damper, *n*, thus checking the flow of gaseous matters to the chimney, and *vice versa*, thereby preventing the waste of fuel. By the interposition of the fluid, the diaphragm is effectually preserved from being destroyed, as is the case when the steam is allowed to come in contact with it. The arrangement of the spring, *g*, also provides for the gradual opening and shutting of the damper, and avoids any sudden jerk or reaction of the parts. Fig. 4 represents another modification of the damper apparatus, in which it is arranged to actuate a throttle valve damper. The apparatus is made so that it may be readily fixed upon or to the face of a flue. The pipe, *a*, is partly filled with water, as in the former arrangement, and the steam acts on this water, and raises the diaphragm, *c*, in the chamber, *b*, the upward motion of which operates the lever, *e*. This lever is connected by the rod, *h*, to the link, *i*, which is attached to the damper, *j*. In this way, when the pressure of the steam increases beyond the required point, the diaphragm rises, and the throttle is closed to a corresponding extent. The apparatus may also be arranged with a segmental rack, working spur, or bevel gearing, for actuating the throttle, to adapt it for marine engines.

Fig. 3.

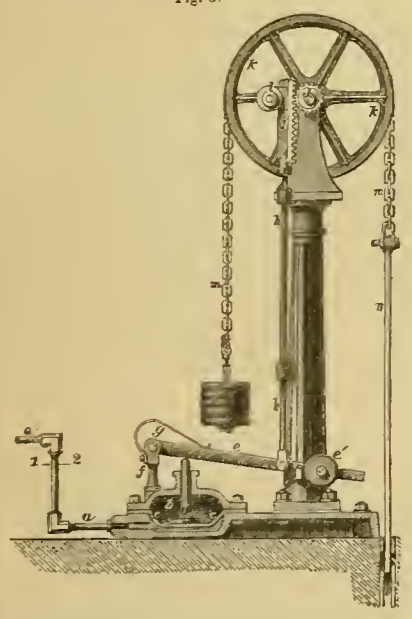
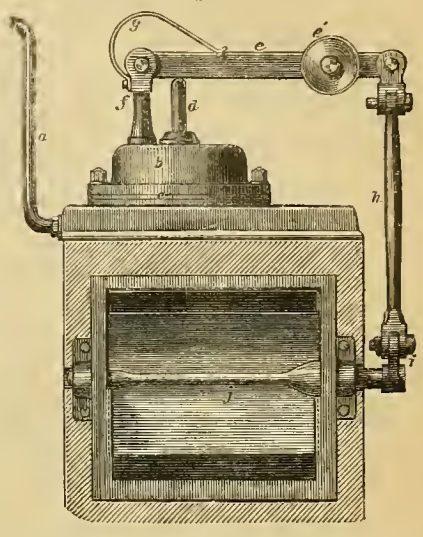


Fig. 4.



FIRE ARMS.

J. H. Johnson, *London and Glasgow* (Cormier & Co., *Paris*)—*Patent dated April* 11, 1862.

This invention refers more particularly to that class of fire arms wherein the distance between the sights is considerably longer than the length of the barrel. The accompanying figure represents an elevation of the improved construction of fire arm. Two projecting studs, or pins,

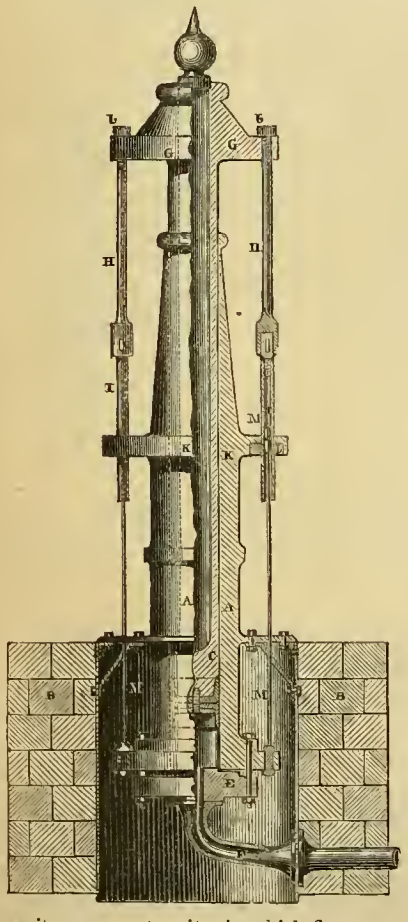
are formed on the tumbler or trigger frame, which fit into cavities in the central plate or tail of the barrel; the tumbler being firmly adjusted in its place, so soon as the guide of the percussion rod has been placed in front. To remove the tumbler, the mechanism of the percussion rod is withdrawn, and the tumbler pushed back in the opposite direction to the studs, which are thus withdrawn from their recesses. The elevation sight is mounted upon an axis, and its lower portion bears against a bent spring, the two ends of which rest upon the central plate. The third and most important part of this invention consists of a radical modification of the arrangements hitherto employed, and embraces a system of arm in which both the central metal blade and the spring for the percussion rod are dispensed with. In this modification, the percussion is effected by a tumbler, mounted in the usual manner, to release the cock, Y, the lower part of which is curved in such a manner as to push forward the

percussion rod, z, so soon as this portion comes in contact with the end of that rod, at whatever portion of the throw of the cock such contact may occur. It may be here remarked that the form of the lock is the same as that used in ordinary arms of precision. The cock, Y, is at the side, so as to afford a rest when carrying the gun on the arm. The percussion rod, z, is placed on the side of the gun also, and is partly enclosed in the stock, which is solid, and contained between the straps, T, which terminate the barrel, *u*, and replaces the central metal blade or plate before referred to. On the right side of the stock are disposed the percussion rod, z, and the nipple; whilst on the opposite side are adapted the same rod, P. The cap is adjusted on to the nipple, by simply pushing back the rod, z, which, being without a spring, slides with the slightest effort in its guide. The rod should be again pushed on to the cap, in order to force it well on to the nipple, and keep it in its place. When the gun is capped, the cock, in firing, strikes the rear end of the rod, z; and as its forward extremity is in contact with the cap, the blow transmitted explodes the cap and fires the charge. The elevation sight in this arm has the spring fixed to the upper strap, against which it is held by screws.

DRAWING METALS.

L. Christoph, *Paris;* W. Hawksworth, *Linlithgow;* & G. P. Harding, *Paris.—Patent dated April* 10, 1862.

The improvements specified under these letters patent, have reference to machinery or apparatus for drawing metals, whether of a tubular, hollow, or solid section, and consist in the application to that purpose of hydrostatic pressure, in lieu of the ordinary mechanical power heretofore adopted.



The subjoined engraving represents a partially vertical section and elevation of one form of hydrostatic apparatus, by means of which, a number of cylindrical tubes of the same or different diameters may be drawn simultaneously. This apparatus is actuated by hydrostatic pressure. It consists of a long hydrostatic cylinder, A, securely fixed to the brickwork, B, and having within it a strong hollow cast-iron piston rod or ram, C, provided at its lower end with a leather packing, D, fitting accurately the bore of the cylinder. The cylinder, A, is terminated at its lower extremity by a strong cover, E, bolted thereon, and having a pipe, E, attached to it for the inlet of the water which is pumped into it in the usual manner adopted for hydrostatic presses. The body of the ram is made in one piece with a strong and wide flange or collar, G, which is cast, or otherwise formed, or fitted thereon, near its upper extremity, in which flange or collar are made a series of apertures for the reception of the ends of the draw rods, H, which are firmly secured at their lower extremities to the corresponding tubes, I, to be drawn, and are retained at their upper ends by the strong nuts, J. Near the middle of the cylinder, A, is formed a somewhat similar flange or collar, K, in which are made a series of holes corresponding in position to those in the flange, G, in which apertures are fitted the draw plates or wordles, L. To the flange of the cylinder cover, E, are secured in any convenient manner the lower ends of the mandrels, M, by means of which, in combination with the draw plates, the tubes are drawn. In working the apparatus the piston or ram is first lowered to the bottom of its stroke, when the smaller end of the tube is secured to the rod, H, in any suitable manner. The mandrels are then so adjusted that the enlargements or swellings will be within the tubes, and about the middle of the draw plates. The pump is now operated, when the ram will commence to rise, and will draw with it the several rods, H, and the tubes attached thereto. By this means a steady and powerful tractive power is applied to the tubes which will be all drawn simultaneously through the draw plates. The same arrangement is of course applicable to tubes of various sections other than circular.

LAW REPORTS.

Sewing Machines: Blackburn *v.* Carter.—This case was tried at the Salford Court of Record, before the judge, Mr Joseph Kay. The case excited some interest amongst manufacturers and workers of sewing machines, and occupied a considerable time in the hearing. The plaintiff is a butter merchant of Rochdale, and the defendant a sewing machine manufacturer of the same place. The action was to recover £12 10s for breach of warranty. The plaintiff's evidence, which was supported by three other witnesses, was that he had bought a "No. 2 Thomas's" machine from the defendant, in November last, for £12 10s, the defendant taking a "Lancashire" machine in exchange, for £6, as part payment. He explained to defendant that he wanted the machine to do the finer description of ladies' dressmaking, such as sewing muslins, lawns, silks, and satins. The defendant replied that his machine was just the one for the work; it was equal to Wheeler and Wilson's, or even to the "Great Thomas's;" and, in fact, he would warraut it to sew properly anything, "from muslin to leather," and he would engage to keep it in good working order for twelve months; it should be a good and perfect machine. Accordingly, the machine was purchased, but it was found that it would neither sew fine work, nor any other work properly. The defendant made some alterations in it without improving it; and in March he declined to have anything more to do with it; hence the action. Two machine makers were called, who stated that they had examined the machine, and that it was not fit to do any kind of work properly, and could not be made to do fine work at all. In fact, the No. 2 machine was not suited for fine work. The defendant alleged that the only warrant he gave was that the machine would be fit for general dressmaking and domestic purposes, and that the machine supplied was fit for such purposes before it had been tampered with by the plaintiff. It was a good and perfect machine. In cross-examination, however, he admitted that he had made alterations in the machine, such as altering the tension, etc. Several scientific witnesses were called in support of the defendant's case, and stated that the machine could be made to do its work well, with an outlay of about 8s. They considered that the defendant's requiring it to be remedied arose from the machine being tampered with by non-competent workmen. They all said that the No. 2 was sold more frequently than any other machine for general domestic purposes. Mr Pope, for the plaintiff, contended that the contract to supply a machine suited to do fine work was fully made out, and if that was so, it was evident, even from the defendant's case, that the contract had not been fulfilled. The fact of his having made alterations in the machine was sufficient to show that he did not consider it a perfect one. After a careful summing up by the judge, the jury returned a verdict for the plaintiff for the full amount claimed. In the course of the case, it was elicited that the so-called "No. 2 Thomas's" machine was not really Thomas's at all, but a close imitation of his patent.

MECHANIC'S LIBRARY.

Arithmetic, Haddow's. New Edition. 12mo, 1s 6d, cloth. Arman.
Exhibition, Handbook to the. Vol 2. 12mo, 4s. Hunt.
Facts, a Million of. New Edition. Post 8vo, cloth. Phillips.
Memory, and the Means of Improving it. Second Edition. 2s 6d, cloth. Pick.
Memory, Science of, Simplified and Explained. fcap. 8vo, 3s. Bacon.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

THE TESTING OF ANCHORS AND CABLES.

Sir,—You, no doubt, are aware that the committee of Lloyd's Registry

passed a resolution early this year for the purpose of securing proper cables and anchors on board merchant ships, to the effect that no new vessel, after the 1st of January next, will get an A 1 certificate unless the chains and anchors shall have been tested to the Admiralty standard at approved machines, when possible, and be in other respects equal to the particulars of their table of proportions No. 22.

The propriety and necessity for so important an object need no comment, and it has the full sanction of Government.

The committee some time ago, in order to secure the desired result at the port of London, engaged me professionally to plant and to establish a testing machine of the most powerful and suitable character on a site selected at the West India Docks, where will be offered the best possible convenience for the intended purpose, so as to secure the utmost economy by its central position and the ease of approach to it.

It is contemplated to put it up on the very best terms for the duty to be performed, thereby to assure satisfaction to the manufacturer and the ease of approach to it.

As it is progressing rapidly, I have pleasure in advising you that I fully expect it will be ready for public use the end of October. Yours,

THOS. M. GLADSTONE.

Lloyd's Register of British and Foreign Shipping,
Cornhill, September, 1862.

EXPLOSIONS OF COPPER GAS-PIPES.

It has been discovered that when gas-pipes constructed of copper or bronze have been long submitted to the action of ordinary coal-gas an explosive compound of copper and acetylen (one of the many ingredients of coal-gas) is formed. When dry, this compound detonates with extraordinary violence as soon as it is rubbed, struck, or heated. Already some accidents have occurred, and some workmen have lost their lives while cleaning large copper gas-pipes from this circumstance. No such explosive compound appears to be formed when iron or lead are used. It is evident that large copper gas-pipes are unsafe, and that some other metal should be substituted for the copper, as the latter may give rise to explosions at any moment. As concerns small pipes constructed of this metal, they should not be allowed to get foul, and when about to be cleaned hydrochloric acid should be introduced into them for about ten minutes before they are submitted to any heat or friction. Hydrochloric acid decomposes the explosive compound, combines with the copper, and puts the gas acetylen in liberty. The acid may then be washed out with hot water. Yours,

T. L. PHIPSON, Ph. D., F.C.S., &c.,
Analytical Chemist.

Putney, October, 1862.

SIGNALS FOR RAILWAY TUNNELS.

SIR,—The probability of accidents occurring in railway tunnels would much be diminished, if an expedient, such as I will now describe, were adopted. It is that alarums, which should properly be covered, be placed at both extremes of a tunnel, and connected by a chain passing through it close to the brickwork, at any required altitude, which chain should move over pulleys. It would, of course, be necessary that the alarums be kept wound, and the engine-driver and guard should be furnished with hooked rods, with which, if necessary, they could pull the chain, and thus ring the bells. An objection to simple bells is that the wind might drive their clappers to their sides.—J. ALEX DAVIES.

October, 1862.

BOILER DEPOSITS.

SIR,—In your September number I read with great pleasure an article on "Boiler Deposits and Incrustations," as preface to the translation of M. Conste's Memoir on Boiler Deposits, by Mr. Robert Trefusis Mallet.

I believe that in ventilating the question of Boiler Deposits in the manner you have done, real good service is rendered to the country at large, as it must result in the greater economy of coal, a consideration which England ought not to overlook, especially when we hear the cry of certain large coalfields of ours coming towards an end. It must also tend to the preservation of human life in being a great means of preventing, to some extent, the fearful number of boiler explosions now so very common amongst us.

In speaking of the means used to prevent deposit, mention is made of four kinds—1st, filtration of the water before entering the boiler; 2d, the application of collecting vessels; 3d, the addition to the water of bodies, for the purpose of preventing aggregation; and 4th, the addition of chemical substances to render the less soluble salts of the water more soluble. It is further stated, that amongst the hundred and one patents not one fully answers its purpose, and thus intimates to your readers that amongst patent records there is not to be found anything better than the above-mentioned four means, and then the process of blowing off is referred to for the purpose of mitigating the amount of deposit.

Now, I should not have troubled you with this paper if I had not thought the subject of great importance, and been in possession of a plan that I believe to be destined to effect much good, and to be much superior to anything else out for the purpose.

I have great pleasure in enclosing particulars, which will be sufficient, I have no doubt, in explaining the plan, and I have no objection that it should have illustration in your very valuable journal.—THOS. SYKES.

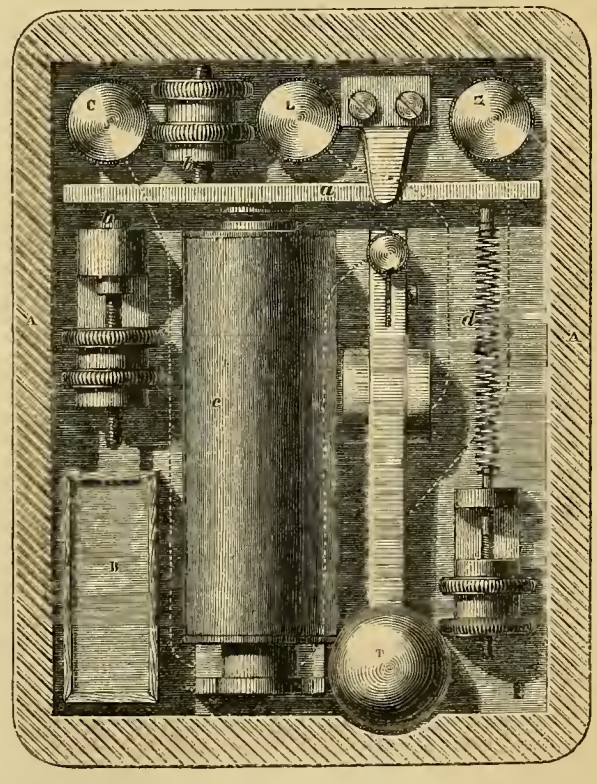
Cleckheaton, near Leeds, Oct., 1862.

[The arrangement referred to will be illustrated in our next]

PORTABLE TELEGRAPH INSTRUMENT.

SIR,—I have the pleasure to enclose herewith a full-sized sketch of a portable Telegraph Instrument Receiving and Transmiting Apparatus combined, the construction of Mr. E. Faulkner, an Inspector in the Government Telegraphs in this Presidency, and if you think it worthy of a place in your valuable journal, I should be glad if you would insert it.

The instrument is an electric-magnetic one, the signals being made by the sound of the armature, *a*, coming in contact with the stud, *b*, when attracted by the coil, *c*. The play of the armature is regulated by the spiral spring, *d*, and the studs, *bb*, all which are prevented from shifting when once adjusted by collar screws.



The screws, C and Z, are for the battery connections, and that at L for the line. The transmitting key, T, is of the same description as those usually adopted for the Morse Instrument. The dotted lines represent the position of the connecting wires as laid in the bottom of the instrument. The small box shown at B contains the spare spiral springs and screws. The whole is enclosed in a box, A, 4 inches long, 3 inches wide, and 1¾ inches deep, with the cover closed. To render it more complete a trough of the same dimensions contains a sand and acid battery, which has been found sufficient in strength for all inspection purposes. An instrument not much larger than the one herein described, but on a modified plan, constructed by the same gentleman, has long been in use in this section of the Department, and been found invaluable on account of its portability, a most necessary thing in a country where travelling is as difficult as in India.—GEORGE J. MOBERLY.

Madras Telegraph Office, August, 1862.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE BRITISH ASSOCIATION AT CAMBRIDGE, 1862.

The thirty second annual meeting of the association took place this year in Cambridge. The University and Municipal Authorities made ample preparations for the accomodation of the meeting, and did their utmost to contribute to the comfort of the members. The several museums, public buildings, and the Botanic Gardens were thrown open daily, during the meeting of the association.

The general committee held its first meeting, Oct. 1, in the Council-chamber, Guildhall, for the election of sectional officers and the despatch of business usually brought before that body. Mr W. Fairbairn, F.R.S., President of 1861, took the chair at 1 o'clock.

The minutes of the meeting of the general committee at Manchester in 1861 were read by Professor Phillips, assistant general secretary, and confirmed.

The report of the council was also presented:—

The Council were directed by the general committee at Manchester to maintain the establishment of the Kew Observatory, and a grant of £500 was placed at their disposal for the purpose. They now laid before the general committee the report of the Kew committee for 1861-2. A sum of £40 was placed at the disposal of the Kew committee for the employment of the photobeliometer, and a further sum of £150 for the purpose of obtaining a series of photographic pictures of the solar surface, with the co-operation of the Royal Society. The report of the Kew committee made known the results of these recommendations. The counsel expressed their regret at the absence from this meeting of the general secretary, Mr Hopkins, through indisposition. Professor Phillips requested to be allowed to withdraw at the end of the present year from the office of assistant general secretary, to which he had been appointed, by annual election in the general committee, for nearly 32 years. Having for two years received the useful aid of Mr G. Griffith, M.A., of Jesus College, Oxford, he expressed to the council his conviction of the fitness of that gentleman to undertake the duties which had been so long entrusted to himself. The council, having considered the subject, and having ascertained from Professor Phillips that he would be happy to co-operate with Mr Hopkins, as joint general secretary in the next year, recommended that the arrangement here suggested be carried out by the general committee. This suggestion met with general concurrence. Mr Taylor having requested that on account of his great age he might be relieved of his duties as general treasurer and co-trustee of the association, the warmest thanks of the council were given to Mr Taylor for his most valuable services, Sir Philip de Grey Egerton, thereupon accepted the office of joint trustee of the British Association; and Mr W. Spottiswood undertook the duty of general treasurer to the association. The first general meeting was held in the Guildhall, in the evening at eight.

Mr Fairbairn, F.R.S., the retiring president of the Association, who was loudly cheered on presenting himself, said,—Ladies and gentlemen, it is my pleasing duty to introduce to you Professor Willis, the next chairman of the British Association. I need not refer to the services which Professor Willis has rendered to science; they are well known in Cambridge and in the country, and appreciated by all the learned societies of Europe. I congratulate you on his appointment to the chair, and I am quite sure it will do honour to the British Association. Last year, at the meeting in Manchester, there were brought forward many subjects of great interest to science, which were most ably discussed, and I have no doubt the result of the meeting now taking place under the auspices of the learned Professors of Cambridge will be equally successful. It therefore gives me great pleasure to introduce to you my learned friend Professor Willis, and to resign the chair to that gentleman, who will now address you for the first time as President of the British Association. Professor Willis, who was received with great cheering, then took the chair, and delivered the following address:—

Gentlemen of the British Association,—I have the honour to announce to you that we are now opening the 32d meeting of the British Association, and are for the third time assembled in this University. At its first coming hither in 1833, its organization was scarce completed; its first meeting having been devoted to explanations, discussions, and allotment of work to willing labourers; its second meeting to the reception of the first instalment of those admirable preliminary reports which served as the foundation of its future labours, and to the division of scientific communication to the sectional committees. But it was at Cambridge that the original plan of the Association bore fruit by the receipt of the first paper, which contained the results of experiments instituted expressly at the request of the Association. The success of the Association was now confirmed by the numbers of compositions and annual subscriptions paid in, and by the help of these funds a most important measure was introduced—namely, the practice of granting in aid of philosophical researches, to be undertaken by individuals or committees at the request of the Association, sums of money to meet the outlay required for apparatus or other expenses, which could not be asked from persons who were otherwise willing to devote their time to the advancement of science. It was at Cambridge that the importance and authority of the Association had become so manifest that the first of its applications for Government assistance towards scientific objects was immediately complied with by the grant of £500 to reduce the Greenwich observations of Bradley and Maskelyne. At this third meeting improvements were made in the distribution of the sciences to the sections, and a section of statistics added. The only change in this respect that was subsequently found necessary was in the establishment of a separate section for mechanical science applied to the arts, in 1837. The employment of alphabetical letters to distinguish the sections had been introduced in 1835. I have said enough to claim for the Cambridge meeting the honour of completing the development of the Association; and I may be permitted to quote from our fourth report the gratifying assurance that so obvious was the utility of the proposed undertaking that in its very infancy there were found several distinguished individuals, chiefly from the University of Cambridge, who volunteered to undertake some of the most valuable of those reports which appeared in the first volume of the proceedings. With a mixture of regret and shame I confess that although my name is enrolled in the honourable list of those who undertook reports, it will be sought in vain among those who promptly performed their promises. Yet I may be permitted to say that I still hope to be enabled at some future time to complete the "Report on Acoustics," of which I delivered merely an oral sketch at the second meeting of the Association in 1832. The Association quitted Cambridge to pursue, with its matured organization and with continually increasing stability and influence, the career of brilliant and useful labours in every branch of science that it has never ceased to run during the two-and thirty years that have elapsed since its foundation. It revisited Cambridge after an interval of 12 years in 1845; and now, after a lapse of 17 years, we have the high gratification of welcoming once more the Association to this scene of its early meetings. This appears a fitting occasion for a concise review of the leading principles and prominent labours of the body. Scientific societies, as usually constituted, receive and publish papers that are offered to them by individuals, but do not profess to suggest subjects for them or to direct the modes of investigation, except in some cases by offering prizes for the best essay on some given branch. This Association, on the contrary, is not intended to receive or record individual originality. Its motto is suggestion and co-operation, and its purpose is thus to advance science by co-operation in determinate lines of direction laid down by suggestion. To give form and authority to this principle the admirable conception of suggestive reports was in the first place developed—a collection that should constitute a general survey of the sciences as they stood at the foundation of the meeting, each branch reported by some member who had already shown his devotion to the cultivation of it by his own contribution to its advancement, and each report passing in review its appointed subject, not for the purpose of teaching it, but of drawing forth the obscure and weak places of our knowledge of it and thus to lay down the determinate lines of direction for new experimental or mathematical researches which it was the object of the Association to obtain. The requests for these reports were zealously responded to, and so rapidly that at the second meeting ten were received, and at the third eight others. In this manner in five or six years the cycle of the sciences was well nigh exhausted. But the series of such reports has been maintained in succeeding years even to the present time by the necessity of supplementary reports to point out not merely the advances of each science already treated, but the new lines of direction for inquiry that develope themselves at every step in advance. The reports thus described were entitled, "On the Progress and Desiderata of the respective Branches of Science," or "On the State of our Knowledge respecting each Science," and must be considered as merely preparations for the great work for which the Association was founded. They constitute the suggestive part of the scheme. The co-operative mechanism, by which each new line of research recommended in the reports was to be explored, was energetically set in motion by the annual appointment of committees or individuals to whom these especial investigations were respectively assigned with adequate sums at their disposal. These committees were requested to report their labours from year to year, and thus a second set of documents have been produced entitled "Reports of Researches undertaken at the request of the Association," which are entirely distinct from the "Suggestive Reports," but immediately derived from them and complementary to them. Such is a concise view of the system at first laid down by the wisdom of our founders, and which with some modifications has produced the inestimable contents of our printed volumes. In practice the "Suggestive Report" is often a paper contributed by some able investigator to some meeting of the Association, which produces a request from the body that he will pursue his researches with their sanction and assistance, and with a report complementary to his own suggestions. Again, although we do not profess to receive and publish individual researches, the number of these received at each meeting is very great, the merit of some of them so eminent that they are authorized to be printed entire among the reports, and the notices and abstracts of the remainder, which at first occupied a small proportional part of each volume, now occupy nearly half of it. I will now direct your attention to the principal objects to which its funds have been directed. To appreciate the value of an investigation by the money it costs may appear at first sight a most unworthy test, although it be a thoroughly British view of the subject. But there are undoubtedly a great number of most important inquiries in science that are arrested not for want of men of zeal and ability to carry them out, but because from their nature they require an outlay of money beyond the reach of the labourers who ardently desire to give their time and thoughts to them, and because the necessity and value of the proposed investigations are wholly inappreciable by that portion of society who hold the purse strings. But it is in the cases above alluded to of expensive investigation that the direct use and service of our body has been made the most manifest. The British Association holds its own purse strings, and can also perfectly understand when they should be relaxed. Nay, more, by its influence and character, established by the disinterested labours and successful exertions of more than 30 years, it may be said to command the national funds, for the objects in aid of which Government assistance has been requested have been so judiciously chosen that such applications have very rarely been unsuccessful, but have been on the contrary most cordially acceded to. Indeed, it may be observed, that from the period of the foundation of the Association the Government of this country have been extending its patronage of science and the arts. We may agree with the assertion of our founder, Sir David

Brewster, in supposing that this change was mainly effected by the interference of this Association and by the writings and personal exertions of its members. For the above reasons it appears to me that by a concise review of the principal objects to which the funds of our body have been applied, and of those which its influence with the Government has forwarded, we obtain a measure of the most important services of the British Association. In considering the investigations carried out by committees or individual members by the help of the funds of the Association, it must always be remembered that their labours, their time and thoughts, are all given gratuitously. One of the most valuable gifts to science that has proceeded from our Association is the series of its printed reports, now extending to 30 volumes; yet these must not be supposed to contain the complete record even of the labours undertaken at the request and expense of the body. Many of these have been printed in the volumes of other societies, or in a separate form Several, unhappily, remain in manuscript, excluded from the public by the great expense of publication. I am the more indnced to direct attention to this great work at present because I hold in my hand the first printed sheets of a general index to the series from 1831 to 1860, by which the titles and authors of the innumerable memoirs upon every possible scientific subject which are so profusely but promiscuously scattered through its 18,000 pages, are reduced to order and reference to them rendered easy. This assistance is the more necessary because so many investigations have been continued with intermissions through so many years, and the labour of tracing any given one of them from its origin to its termination through a series of volumes is extremely perplexing For this invaluable key to the recorded labours of the Association we are indebted to Professor Phillips, and the prospect of its speedy publication may be hailed as a great subject of congratulation to every member of our body. In every annual volume there is a table of the sums which have been paid from the beginning on account of grants for scientific purposes. The amount of these sums has now reached £20,000, and an analysis of the objects to which this expenditure is directed will show that if we divide this into eighteen parts it will appear speaking roughly, that the section of mathematics and physics has received 12 of these parts—namely, two-thirds of the whole sum; the sections of geology and mechanical science two parts each, while one part has been given to the section of botany and zoology, and one divided among the sections of chemistry, geography, and statistics. The greater share assigned to the first section is sufficiently accounted for by the nature of the subjects included in it, which require innumerable and expensive instruments of research, observations, and expeditions to all parts of the globe. If we examine the principal subjects of expenditure, we find in the first place that more than £1,800 was expended upon the three catalogues of stars—namely, the noble catalogue which bears the name of the British Association, commenced in 1837 and completed in eight years; and the star catalogue from the observations of Lalande and Lecaille, commenced in 1835 and 1838, and reduced at the expense of the British Association, but painted at the expense of Her Majesty's Government. £150 was applied principally to the determination of the constant of lunar nutation under the direction of Dr Robinson in 1837, and to several other minor astronomical objects. At the very first meeting at York the perfection of tide tables, hourly meteorological observation, the temperature of the atmosphere at increasing heights, of springs at different depths, and observations on the intensity of terrestrial magnetism, were suggested as objects to which the nascent organization of the Association might be directed. Its steady perseverance, increasing power and influence, as successive years rolled on, is marked by the gradual carrying out of these observations so as to embrace nearly the whole surface of the globe. Thus, under the direction of Dr Whewell, a laborious system of observations obtained by the influence and reduced at the expense of the Association, who have aided this work with a sum of about £1,300, has determined the course of the tide wave in regard to the coasts of Europe, of the Atlantic, of the United States, of New Zealand, and of the east coast of Australia. Much additional information has been since collected by the Admiralty through various surveying expeditions, but it appears that much is still wanting to complete our knowledge of this subject, which can only be obtained by a vessel specially employed for the purpose. More than £2,000 has been allotted to meteorology and magnetism, for the construction of instruments, and the carrying out of series of observations and surveys in connection with them. To this must be added a sum between £3,000 and £3,000 for the maintenance of Kew Observatory, of which more anon. The advance made in these important sciences through the labours of committees of the British Association may be counted among the principal benefits it has conferred. To the British Association is due, and to the suggestion of General Sabine, the first survey ever made for the express purpose of determining the positions and values of the three somagnetic lines corresponding to a peculiar epoch over the whole face of a country or State. This was the magnetic survey of the British Islands, executed in from 1834 to 1838, by a committee of its members—General Sabine, Professor Phillips, Sir J. Ross, Mr Fox, and Mr Lloyd, acting upon a suggestion brought before the Cambridge meeting in 1833 It was published partly in our volume for 1838, and partly in the *Philosophical Transactions* for 1849. This was followed by a recommendation from the Association to Her Majesty's Government for the equipment of a naval expedition to make a magnetic survey in the southern portions of the Atlantic and Pacific Oceans. This recommendation, concurred in by the Royal Society, gave rise to the voyage of Sir James Clark Ross in the years 1839 to 1843. In a similar manner was suggested and promoted the magnetic survey of the British possessions in North America, authorized by the Treasury in 1841; the completion of the magnetic survey of Sir James Ross by Lieutenant Moor and Lieutenant Clerk in 1845, in a vessel hired by the Admiralty; the magnetic survey of the Indian seas by Captain Elliot in 1849, at the expense of the Directors of the East India Company; and the magnetic survey of British India, commenced by Captain Elliot in 1852, and completed between 1855 and 1858 by Messrs Schlagintweit. Finally, in 1857, the British Association requested the same gentlemen who had made the survey of the British Islands in 1837 to repeat it, with a view to the investigation of the secular changes of the magnetic lines. This has been accomplished, and its results are printed in the new volume for 1861. The Association also, aided by the Royal Society, effected the organization in 1840 of the system of simultaneous magnetical and meterological observations established as well by our own Government as by the principal foreign Governments at different points of the earth's surface, which have proved so eminently successful, and have produced results fully equalling in importance and value, as real accessions to our knowledge, any anticipations that could have been formed at the commencement of the inquiry. General Sabine, whose labours have so largely contributed to these investigations, has given to the University an admirable exposition of the results during the present year, in the capacity of Sir Robert Rede's lecturer. In 1854, in consequence of representations originating with the British Association, our Government created a special department in connexion with the Board of Trade, under Admiral Fitzroy, for obtaining hydrographical and meteorological observations at sea, after the manner of those which had been for some years before collected by the American Government at the instance and under the direction of Lieutenant Marcy. Observations on the wind have been carried on by means of the various self-registering anemometers of Dr Whewell, Mr Osler, Dr Robinson, and Mr Beckley, which instruments have been improved, tested, and thoroughly brought into practice by the fostering care of our body; and by the aid of its funds experiments have been made on the subterranean temperature of deep mines, and on the temperature and other properties of the atmosphere at great heights by means of balloon ascents. Four of these were made in 1852, in which heights between 19,000ft. and 20,000ft. were reached. But in the present year Mr Glaisher has attained an altitude of nearly 30,000ft. We may hope that some account of this daring achievement, and its results to science, may be laid before the Association at its present meeting. Earthquake shocks were registered in Scotland by a committee of the Association from 1841 to 1844, and Mr Mallet commenced in 1847 a most valuable series of reports on the facts and theory of earthquake phenomena from the earliest records to our own time, which have graced our volumes even to the one last published. One of the most remarkable and fruitful events in our history in relation to physical observations is the grant by Her Majesty in 1842 of the observatory erected at Kew by King George III., which had been long standing useless. It gave to the society a fixed position, a depository for instruments, papers, and other property, when not employed in scientific inquiry, and a place where members of the Association might prosecute various researches. This establishment has been during the 20 years of its existence gradually moulded into its present condition of a most valuable and unique establishment for the advancement of the physical sciences. After the first few years its existence was seriously perilled. In 1845 the expediency of discontinuing this observatory began to be entertained, but upon examination it appeared that the services to science already rendered by this establishment, and the facilities it afforded to members of the Association for their inquiries, were so great as to make it desirable to maintain it. Again, in 1848, the burden of continuing this observatory in a creditable state of efficiency pressed so heavily upon the funds of the Association, then in a declining state, that the Council actually recommended its discontinuance from the earliest practicable period. This resolution was happily arrested. In 1850 the Kew Committee reported that the observatory had given to science self recording instruments for electrical, magnetical, and meteorological phenomena already of great value, certainly capable of great further improvement, and that if maintained merely as an experimental observatory, devoted to open out new physical inquiries and to make trial of new modes of research, but only in a few selected cases to preserve continuous records of passing phenomena, a moderate annual grant from the funds of the Association would be sufficient for this most valuable establishment for the advancement of the physical sciences. In this year it fortunately happened that Lord J. Russell granted to the Royal Society the annual sum of £1000 for promoting scientific objects, out of which the society allotted £100 for new instruments to be tried at Kew—the first of a series of liberal grants which have very greatly contributed to the increasing efficiency of the establishment; but we have insured its continuance. It now contains a workshop fitted with a lathe, tools, planing machine, &c., by which apparatus can be constructed and repaired, and a dividing engine for graduating standard thermometers, all presented by the Royal Society. The work done, besides the maintenance of a complete set of self-recording magnetographs, established in 1857, at the expense of £250, by the Royal Society, consists in the construction and verification of new apparatus, and in the verification of magnetic, meteorological and other instruments sent for that purpose by makers. For example, all the barometers, thermometers, and hydrometers required by the Board of Trade, and Admiralty are tested, standard thermometers are graduated, magnetic instraments are constructed, and their constants determined for foreign or colonial observatories. Sextants also are verified. An example of its peculiar functions is given in the very last report for 1861, when it appears that an instrument contrived by Professor William Thomson, of Glasgow, for the photographic registration of the electric state of the atmosphere has been constructed by Mr Beckley in the workshop of this observatory, with mechanical arrangements devised by himself, and that it has been in constant and successful operation for some time. Those who have experienced the difficulty of procuring the actual construction of apparatus of this kind devised by themselves, and the still greater difficulty of carrying out the improvements and alterations required to perfect it when brought into use, will agree that the scientific importance and utility of an establishment cannot be overrated in which under one roof are assembled highly skilled persons, not only capable of making and setting to work all kinds of instruments for philosophical research, but also of gradually altering and improving them as experience may dictate. The creation of this peculiar observatory must be regarded as one of the triumphs of the British

Association. As far as the Association is concerned, its maintenance has absorbed between £5000 and £6000, and the annual sum allotted to it from our funds has for each of the last six years reached the amount of £500. The construction of the photoheliograph may be quoted as an example of the facilities given by this establishment for the developing and perfecting of new instruments of observation. A suggestion of Sir John Herschell in 1854 that daily photographs of the sun should be made has given birth to this remarkable instrument, which at first bore the name of the solar photographic telescope, but is now known as the Kew photoheliograph. It was first constructed, under the directions of Mr De la Rue, by Mr Ross, &c. The British Association aided in carrying out this work by assigning the dome of the Kew Observatory to the instrument, and by its completion in 1857 in their workshop by Mr Beckley, the assistant; but the expense of its construction, amounting to £180, was supplied by Mr Oliviera. On occasion of the eclipse in 1860 this instrument was conveyed to Spain, under the care of Mr De la Rue, who most successfully accomplished the proposed object by its means, and was replaced at Kew on his return But to carry on the daily operation for which it was constructed requires the maintenance of an assistant, for which the funds of the association are inadequate, although it has already supplied more than £200 for that purpose. Mr De la Rue, in consequence of the presence of the heliograph at Kew being found to interfere with the ordinary work of the establishment, has kindly and generously consented to take charge for the present of the instrument at this observatory and at his own observatory when celestial photography is carried on. But it is obvious that the continuation of these observations for a series of years, which is necessary for obtaining the desired results, cannot be hoped for unless funds are provided. I cannot conclude this sketch of the objects of the physical section to which the funds of the Association have been principally devoted without alluding to Mr Scott Russell's valuable experimental investigations on the motion and nature of waves, aided by £274. If we now turn to geology, we find £2,600 expended; of which £1,500 was employed in the completion of the fossil ichthyology of Agassiz, and Owen's reports on fossil mammalia and reptiles, with some other researches in fossils. The remainder was principally devoted to the survey and measurement, in 1838, of a level line for the purpose of determining the permanence of the relative level of sea and land, and the mean level of the ocean, and to the procuring drawings of the geological sections exposed in railway operations, before they are covered up—a work which was carried on from 1840 to 1844, when the drawings were deposited in the Museum of Practical Geology, and the further continuance of it handed over to the geological surveyors of that establishment. £2,300 has been devoted to the carrying out of various important experimental investigations in relation to the section of mechanical science. Of this sum £900 was paid between 1840 and 1844 in aid of the most important and valuable series of experiments on the forms of vessels, principally conducted by Mr Scott Russell in connection with the experiments on waves. This investigation was ready for the press in 1844, but it is greatly to be regretted that the great expense of printing and engraving it has hitherto prevented its publication. Nearly the same sum has given to us various interesting and instructive experiments and facts relating to steam engines and steam vessels, carried on by different committees from 1838 to the present time, among which may be especially noted the application of the dynamometric instruments of MM. Morin, Poucelet, and Moseley, to ascertain the duty of steam engines from 1841 to 1844. Experiments on the strength of materials, the relative strength of hot and cold blast iron, the effect of temperature on their tensile strength, on the effect of concussion and vibration on their internal constitution, carried on principally by our late president, by the late Mr Eaton Hodgkinson at different intervals from 1838 to 1856, have been aided by grants amounting to £400. The remainder of the sum above mentioned was principally devoted to the experimental determination of the value of railway constants by Dr Lardner and a committee in 1838 and 1841. The section of botany, zoology, and physiology has absorbed about £1,400; of which nearly £900 has been applied to zoology, partly for the expense of dredging committees, for obtaining specimens of marine zoology, on our own coasts and in the Mediterranean and other localities, and whose useful labours have been regularly reported from 1840 to 1861, but principally for zoological researches in different districts and countries. In botany may be remarked the labours of a committee consisting of Professors Daubeny, Henslow, and others, formed in 1840 to make experiments on the preservation of vegetative powers in seeds, who continued their work for 16 successive years, reporting annually, and assisted by a sum of £200. The greatest age at which the seeds experimented upon were found to vegetate was about 40 years. Another committee, with Mr Hunt, was engaged during seven years, from 1841, in investigating the influence of coloured light on the germination of seeds and growth of plants. These are specimens of the admirable effect of the organization of an Association in stimulating and assisting with funds the labours of investigators in new branches of experimental inquiry. It would occupy too much time to particularize a variety of interesting investigations in the remaining sections to which small sums have been assigned. The President then referred to the report of the Manchester meeting, and instanced some of the most striking advances since made in the various sciences. He then said,—Before I conclude, I have the painful duty of reminding you that since our last meeting we have had to deplore the loss of that most illustrious patron of science and art, his Royal Highness the Prince Consort, the President of our Association at Aberdeen, and the Chancellor of this University. In the latter capacity he afforded us many opportunities of observing his scientific attainments and genuine zeal and love for all branches of knowledge. His gracious kindness and respect for men of science and literature have left an impression upon us that can never be effaced. I must also ask a tribute to the memory of our late professors of chemistry and botany, both of whom did in their lifetime excellent good service to science, and more especially to the British Association—Professor Cumming contributing one of the invaluable primary reports upon which our proceedings were based, as well as other communications; Professor Henslow by various reports, some of which I have already alluded to.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, MANCHESTER.

At the last ordinary monthly meeting of the Executive Committee of this Association, Mr. L. E. Fletcher, chief engineer, presented his Monthly Report, of which the following is an abstract:—

"I am happy to be able again to report that no explosion has happened during the past month to any boiler under the inspection of this Association, neither has the occurrence of any in other quarters come to my knowledge.

"During the past month there have been examined 263 engines and 451 boilers. Of the latter 15 have been examined specially, 6 internally, 72 thoroughly, and 358 externally; in addition to which 4 of these boilers have been tested by hydraulic pressure. The following defects have been found in the boilers examined:—Fracture, 8 (1 dangerous); corrosion, 49 (8 dangerous); safety-valves out of order, 3; water gauges ditto, 14; pressure gauges ditto, 4; feed apparatus ditto, 3; blow-off cocks ditto, 16 (1 dangerous) fusible plugs ditto, 5; deficiency of water, 1; blistered plates, 3 (1 dangerous). Total, 106 (11 dangerous). Boilers without glass water gauges, 5; without pressure gauges, 1; without blow-off cocks, 17; without back pressure valves, 25.

"Two boilers have recently been met with, neither of which was fitted with its own separate safety-valve, but both were dependent on a single one placed upon the steam pipe, the communication between which and each boiler was conditional on its junction valve being open, so that had the attendant at any time inadvertently left this valve screwed down—on getting up steam for instance on a change of boilers—the whole steam pressure must have been bottled up without chance of escape.

"Some of our members do not appear to be fully aware of the importance of fixing a feed back pressure valve to each of their boilers, and therefore the following instance; lately met with, of the inconvenience arising from the want of them, may be given.

"Four boilers, set side by side and connected together, were working under their ordinary circumstances, when one of them vomited its water through the feed pipe into the adjoining one, draining itself and over-charging the other. The danger of this, if not immediately detected, with a fire in active operation, will at once be seen. It is, however, by no means an uncommon occurrence where back-pressure valves are omitted, especially where any thickening matter exists in the water, which tends to lift it and cause priming, under which circumstances the water has been found to rush backwards and forwards alternately between boilers working in connection. The back-pressure valve prevents this: the water from the feed pump operating underneath and raising it, while the pressure from the boiler operates on the top and closes it. Necessary as these valves are to the safety of boilers when working in a series, they should not be neglected in the case of those working singly, not only when fed by a pump, but also when fed direct from the waterworks main: in the first case, in order that the pump-valves may be accessible when steam is up, and in the second, that the reflux of hot water from the boiler may be prevented either on the bursting of the pipe or other cause. These valves should be placed immediately upon the shell of the boiler, and not at a distance from it, as is sometimes the case, since scalding might ensue should any joints break in the intervening length of pipe, while repair could not be effected without letting the pressure down. For the same reason the feed stop valve should not be interposed, which it too frequently is, between the back-pressure valve and the boiler, since a disarrangement of the stop valve may entail an entire stoppage, which, had the feed back-pressure valve been placed immediately upon the shell, could easily be rectified with steam up.

"In the construction of this valve care should be taken to limit its rise; for want of which simple precaution some of them have proved to be entirely useless, the water passing freely from one boiler to the other as if the valve were not there. Its most convenient position is at the front end plate of the boiler, nearly on a level with the furnace crown. Its beat can then be heard at every stroke of the engine, and if a screwed spindle be added, so as to convert it into a combined feed-stop and back-pressure valve, which is the best arrangement, then the feed can be regulated without leaving the furnaces.

"A case of scalding has lately occurred in consequence of the failure of the blow-out apparatus of a boiler which was however, not under the inspection of this Association.

"The manner in which blow-out taps are often strained with long levers in opening and closing, renders it a matter of surprise that fracture does not more frequently occur, and many have such inefficient arrangements for carrying off the waste water that it beats back with so much violence on the taps being opened, that their use is quite dangerous. Enginemen are in this way but too frequently scalded severely, and our own Inspectors sometimes meet with narrow escapes. Some taps are so inconveniently placed that the nut at the bottom of the plug is quite inaccessible, and thus becomes neglected, in consequence of which several cases have occurred of the plug being shot out by the force of the steam on being opened. Taps fitted with glands are safer as well as more convenient; they should, however, be made entirely of brass in the shell as well as in the plug, and be fitted with a suitable waste pipe. Those made of cast-iron in the shell and brass in the plug are generally found to be inconvenient, and sometimes dangerous, on account of the unequal expansion of the two metals, from which it is frequently impossible to close them, when the boiler becomes robbed of its water, and the fires have to be drawn to prevent injury to the furnaces.

"The case in question, however, was somewhat peculiar, and the fracture did not arise from either of the above causes. The blow-out tap was attached to the boiler by a cast-iron elbow pipe, and this pipe broke short off without warning, while the boiler was at its regular work and the blow-out tap not being touched.

"The cause of this appeared to be as follows:— Boilers, as it has been previously stated in these reports, are too frequently considered to be in a state of rest when once set upon their brickwork bed; whereas, from the constant changes of temperature, and the consequent contraction and expansion that take place, not only in the boiler itself, but also in the brickwork, the whole is in a continual state of movement. It appears most probable that this action had in process of time induced a slight settlement of the boiler, and thus that a strain was brought upon the cast-iron elbow pipe, which being bound by the brick-work, consequently gave way. A torrent of hot water naturally ensued, which, unable to escape at the usual outlet, found is way into an adjoining building, where it partially flooded one of the floors, and two or three persons became scalded in consequence.

"It may be stated, in brief, that the scum pipes for surface blowing out, which have been recommended from time to time, for the prevention of incrustation in boilers, have now been adopted by several of the members, and have, for some time since, been in very successful operation. An early opportunity will shortly be taken of making more detailed reference to this subject; but, in the meantime, it may be stated that a drawing of the arrangement adopted lies at the office for the inspection of the members, and that full particulars, both of the details of construction and results of working, will be given on application.

"There is one branch of the service this Association affords which the members do not avail themselves of as fully as they might—namely, that of consulting the records at the office before laying down new boilers or making alterations. Full particulars are kept, not only of the construction of the boilers under inspection, but also of the results of their working; and a consultation of these would frequently save unnecessary outlay, prevent failures of one being repeated by others, and place at the command of each member the experience acquired by the inspection of the whole number of boilers under the charge of the Association."

GLASGOW ARCHITECTURAL SOCIETY.

October, 20th, 1862.—This was the annual General Meeting, Mr Alexander Thomson, in the chair. After the production of the usual report the following paper was read:—"On the practice of Measuring Artificers' Work in Glasgow, with remarks on the prevalent system of estimating," by Mr John Shields. —Mr M'Gnffie afterwards exhibited specimens of a Silicate for preserving stone, prepared by Jesse, Rust, & Co., of London.

The King of Hanover has conferred the large gold medal of arts and sciences on M. Methfessel, Chapel Master at the Court, and the oldest of existing German composers.

MONTHLY NOTES.

TRIAL OF THE *RESISTANCE*.

The official trial of speed of this frigate, the fonrth of our iron ships in commission, took place the end of last Septemher, at the measured mile in Stokes Bay, near Portsmonth, with both full and half power, and was attended with the most satisfactory resnlts. Captain Broadhead, commanding the reserve at Portsmonth, who condncted the trials of the *Warrior*, *Black Prince*, and *Defence*, also conducted the trial of the *Resistance*. The other officials on board consisted of Mr G. Murdoch, inspector of machinery afloat, and Mr Ward, assistant to Mr Murray, the chief engineer of Portsmouth dockyard and steam factory. Mr Holliday represented the makers of the engines, Messrs Penn & Son. The ship was nnder weigh hy half-past ten, drawing 23 feet 9 inches of water forward, and 26 feet aft, a little more hy the stern than her sister ship, the *Defence*, drew on her trial, her draught of water on that occasion having heen 25 feet 5 in. aft, and 24 feet 3 in. forward. A run out was first made as far as the Nah light vessel, to secure the anchor and clear the fires, after which she was taken to the trial ground to commence her runs at the mile with fnll boiler power. The weather promised in the early part of the day to be of a very nnfavonrable character, but hy the time the ship had reached the mile the wind had considerahly moderated, and the day eventnally tnrned out nnnsually fine for the time of the year, and therefore favourable for developing the speed of the ship to its fullest extent. In making the runs to the westward the wind was on the ship's port how, and on the returning run to the eastward on her starhoard qnarter. The six runs with full power were made with the following results:—

Run.	Time.		Speed in Knots	Steam.	Vacuum.	Revolntions of Engines.
	Min.	Sec.			Forward. Aft.	
1 ...	4	58	12·080	20lb.	24 ... 23½	67
2 ...	5	17	11·356	,,	,, ... ,,	68½
3 ...	4	43	12·721	,,	,, ... ,,	68
4 ...	5	39	10·619	,,	,, ... ,,	68½
5 ...	4	33	13·186	,,	,, ... ,,	67½
6 ...	5	51	10·256	,,	,, ... ,,	68

Mean speed of the six runs, 11·832 knots.

With half-boiler power, two runs were made as follows:—

Run.	Time.		Speed in Knots.	Steam.	Vacuum.	Revolutions of Engines.
	Min.	Sec.				
1 ...	5	6	11·764	20lb.	27	58
2 ...	6	41	8·977	,,	,,	58

Mean speed of the two, 10·370 knots.

These results give the *Resistance* a superiority in speed over the *Defence*—both vessels heing of precisely the same huild and dimensions, with engines manufactured from the same patterns—at full power of a quarter of a knot, and at half power of no less than 1·315 knots, the latter a very important gain. At the close of the runs at the measured mile the ship took several turns through Spithead to get up her steam again to full power, when she was tested in making circles to port and starboard, the two experiments having the following results:—With helm hard a-starhoard, the rudder was hove over to an angle of 24½ degrees in 40 seconds, with 3¾ turns of the wheel; the half-circle made in 3 minutes and 11 seconds, and the full circle completed in 6 minutes and 19 seconds, the revolutions of the engines heing 59½. With helm hard a-port the rudder was hove over to an angle of 24¼ degrees full in 38 seconds, with 3⅝ turns of the wheel; the half-circle made in 3 minutes 17 seconds, and the full circle completed in 6 minutes 35 seconds, the revolutions of the engines heing 59. The angles of rudder obtained are very remarkahle, as showing a greater power of whcel and tiller over the rudder than has ever yet heen experienced in any of our large screw ships. This increased power is obtained by a simple alteration and addition to the wheel on a plan suggested hy Mr Robinson, assistant-master shipwright of Sheerness Dockyard, by which the spindle of the wheel is sufficiently prolonged to receive an additional wheel to the ordinary two, thus gaining great additional force with the tiller ropes. The tiller is a long massive piece of forged iron, standing out from the rudder-head fore and aft the ship, with a curve from the rudder head to give it play round the screw well, and working over a quadrant which gives the angles of the rudder. So long as rudderheads, gudgeons, and piutles stand, this application of immense power to rudderheads may answer in getting the rudders of our screw ships hard over when required, but an application of steam power helow the water line would he far more simple, efficacious, and free from all danger of accident. In testing the action of the machinery, and the control whicb could he possessed over its working hy the engineer, the engines were stopped dead from full speed in 19 seconds from the time of moving the telegraph to give the order, were started again in 9 seconds, and when again at full speed were stopped and turned astern in 20 seconds. The indicated horse power of the engines was 2,372, or nearly four times their nominal power. The propeller, like those of the other iron ships, is an improved Griffiths, of 18 feet diameter, and with a pitch of 21 feet, having an immersion of its upper edge of 7 feet. The temperatures were:—

	Engine-room. Deg.	Fore Stokehole. Deg.	Aft Stokehole. Deg.
At 11 o'clock ...	91	110	128
At 11.30	98	131	138
At 12	96	162	138
At 12.30	96	132	142
At 1	96	135	146

Under the cowl which admitted the air into the fore stokehole the temperature stood at 100 deg.

The *Resistance* was launched on the 11th of April from Messrs. Westwood and Baillie's yard, near Millwall. She is 292 feet in her extreme length, has a breadth of 54 feet, a depth from her spar deck of 38½ feet, and is of 3,668 tons, hnilders' measurement. Her rig, like her form of hull, is precisely the same as the *Defence*, with the exception that she carries in addition fore and main topgallant yards on sliding gunter poles, which certainly improve her appearance greatly aloft. For armament she carries on the upper deck two 110-pounder pivot Armstrong guns, two 25-pounder Armstrongs, two 32-pounder smooth-bores of 45cwt., besides a 12-pounder Armstrong field-piece and smooth-bore brass pieces for boat service. On her main deck she carries six 95cwt. guns, throwing solid 68lh. shot, and four 110-pounder Armstrongs, all on sliding carriages with directing bars. The general appearance of her decks and their arrangements are all that the most fastidious in such matters could possibly desire. With an utter absence of all useless ornamentation, everything is in splendid order, and has more the appearance of being the result of continued exertions during a two years' commission instead of heing only of as many months. The ship in her equipment carries two things on hoard which are seldom found on board ship—the electric telegraph and gas. The former has been fitted on a plan that was worked for many months on hoard the *Wonga* steamer, running between Sydney and Melhourne, under the superintendence of Mr Gilmore, formerly commander of the *Wonga*. In the *Resistance* it forms a communication hetween the fore and after bridges, and by the officer of the watch at sea moving a handle on a dial plate a needle in a case hanging in front of the quartcr-master at the wheel points to the signal wished to he given,—starboard port, or steady, as required. The whole arrangement is very simple, and cannot well he misunderstood, either by the officer working tbe handle on the forward bridge or the man at the wheel. The gas is manufactured from oil, on Mr Gurney's plan. The gasometer is on the upper deck, hetween the hoom boats and hefore the main hatchway, in a small cahoose. The oil, flowing from a reservoir through a small pipe, enters a retort, when, the gas generated hy the heat, passes into

the gasometer. From the gasometer a pipe conveys the gas below to the engine-room and screw-alley, which, lit up by 12 burners, had a truly brilliant effect, and was wonderfully different to the old oil lamp, which at times only serves to make darkness more visible.

The average annual cost of preserving the hulls and machinery of the Government paddle steamers now in our steam reserves,—and all of which, be it duly remembered, are useless for the future as war ships—is about £1000 each. When we add the interest upon the original cost of the vessels, we find we have an enormous item of perfectly useless expenditure going on in our floating defences.

The Merchant Service.—The 20,119 British vessels, exclusive of river steamers, employed in our home and foreign trade in the year 1860 (tonnage 4,251,739), not including repeated voyages, were manned by 191,888 persons. The masters were 20,296 in number; the mates, 21,069; petty officers, 13,264; A. B. seaman, 62,787; O. S. seamen, 17,514; apprentices and boys, 23,041.

Turner's Cupola.—The model of the fixed cupola and armour-plated ship, invented by Mr Turner, master shipwright of Woolwich dockyard, has been inspected and approved by numbers of the leading private firms. Some of the most eminent shipbuilders of Liverpool recently waited on Mr Turner with a desire of negotiating permission to adopt his principle in ships which they are about to construct for the purposes of the American war. The single copula to be fitted on the deck of Mr Turner's new ship will require no turntable or other machinery, and will contain 26 guns capable of being fired at any required point or deflection, with sufficient space for the free circulation of the gunners. It is 220 feet in length, 10 feet in depth, and 50 feet in breadth. The armour-proof plates will be applied by a patent invention of Mr Turner's, requiring neither grooves nor tongues, and will be removable singly in case of fracture or damage, and also easily replaced. The Board of Admiralty, who inspected the model on their visit to the dockyard a few days ago, have called on Mr Turner to furnish specifications of his method for their consideration. His Royal Highness Prince Adalbert, Admiral of the Prussian fleet, has also ordered draughts of the model to be transmitted to him for the service of his own country. The ship to be built after Mr Turner's design will carry 8,700 tons displacement burden, and will be a most formidable ram, having a powerful weapon of 8 feet in length projecting 3 feet under the water line. Precautions are adopted to have her rudder, stern post, and propeller thoroughly immersed, and consequently out of the reach of damage from without.

On the 16th ult. the *Jaseur*, 5, screw steam gunvessel, 80-horse power, was taken to the measured mile off Maplin Sands, in charge of Captain T. P. Thomson, commanding the steam reserve at Sheerness, for trial of her machinery, previous to her being given up to Government by the contractors. At this trial the pitch of the screw (Griffith's) was set at 14 feet, and the vessel attained an average speed of 8·488 knots per hour, the engines working 87 revolutions per minute, with an abundance of steam. The contractors, thinking that a greater speed might be attained by reducing the pitch of the screw, determined upon having further trials previous to leaving charge of the engines. Accordingly, the vessel was again taken to the measured mile on Monday last, the pitch of the screw having been reduced to 12 feet 6 inches. During the six hours the vessel was under way the engines were kept at full speed; there were no hot bearings, and there was scarcely any perceptible vibration. The results were:—Average speed, 9·142 knots; revolution of engines, 99; vacuum, 24; and pressure of steam, 22, with an abundance of surplus steam. A final trial with the pitch of screw set at 12 feet was made yesterday, when the average revolutions were increased to 104½ per minute; average speed, 9·684 knots; pressure of steam, 22; vacuum, 25. This trial was considered by all parties the most satisfactory, and the machinery will be passed at once over to the Government authorities. The engines were built by Messrs Laird, Brothers, of the Birkenhead Ironworks, and are of similar construction to those exhibited by the same firm in the International Exhibition, and for which a prize medal has been awarded.

The *Edgar*, 86, screw, Capt. the Hon. F. Foley, flagship of Rear-Admiral S. C. Dacres, C. B., in the large double dock at Portsmouth, is having massive metal brackets, or knees, bolted on her after sternpost and stern, to strengthen the sternpost in its position when under steam. Nothing has been discovered of sufficient extent fully to account for the water the ship made when under way a few days since at Spithead, but it is conjectured that the play of the sternpost when under steam may have acted upon a weak part discovered near it, and it is on this account that it has been strengthened with metal brackets. The *Defence*, 16, iron ram, in the eastern end of the same dock, has had her bottom examined to ascertain the extent of the damage caused by her grounding in the Baltic. Beyond the breaking of a few rivets, however, no outward damage is visible. There is no broken plate in her bottom to account for the water she is said to have taken in after she had touched the ground. As soon as the damaged rivets have been made good she will be undocked, and again reported ready for sea. Her bottom, which was coated some three months since with Peacock and Buchan's patent composition, with their new top dressing, is in very good order.

Captain Coles and his Shield Ships.—A correspondent of the *Times*, who has had a controversy in its columns with Captain Coles, says the latter altogether fails to show either that the Admiralty made any mistake in preparing the plans of the *Royal Sovereign*, or that the shield ships will be efficiently protected from that close attack of gunboats to which a Portsmouth correspondent has more than once very ably referred. Captain Coles now admits that he has never contemplated, and does not even now contemplate, the necessity of securing any more than the usual slight depression of fire, for which alone he has made provision in his drawings and models. That being so, it is very difficult indeed to see how gunboats are to be prevented from closely encircling his shield ships, and pouring their fire into them with impunity. It will not do for Captain Coles to reply (as he virtually does) that the same thing might occur to the *Warrior* or any other ship; because all ordinary vessels may drive off gunboats by rifle fire from their tops and from behind their permanent bulwarks, whereas the shield ships will usually be without tops and always without such bulwarks. Besides, even if ordinary ships were exposed to the same evil it would be the bounden duty of Captain Coles, if he is to act up to his professions, to remedy so serious and dangerous a defect. I will only add that if all the depression of fire which Captain Coles requires is seven or eight degrees, as he says, then there was no occasion whatever to build a new deck in the *Royal Sovereign*, because the Admiralty had provided, I am told, for that degree of depression by proposing to place the shields at the necessary height above the deck.

Enterprise and Favorite.—These ironcased vessels now building on adjacent slips in Deptford dockyard are making rapid progress. Nearly the whole of the shipwrights employed thereon are at work extra time. The *Enterprise* is completely in frame, in so far as the wooden hull is concerned, and is ready to receive her planking and internal works. The whole of the frame in the wake of the armour has been filled in solidly, the timbers and fittings being "dowelled" and bolted to each other, to increase the strength of the fabric, in accordance with plans furnished by Mr E. J. Reed, the designer of the ship, who personally superintends the construction. The *Favorite* is also to be framed in the same manner. In the official return of iron plated ships, quoted in *The Times* last week, this vessel is described as a partially cased ship. Since the return was ordered, however, the design of the *Favorite* has been modified by Mr Reed in such a manner as to provide for the complete casing of the ship with armour; and the Admiralty have issued orders for the adoption of this improvement, which has been secured without increasing the immersion of the vessel or interfering with the progress of the work. The *Favorite* will, therefore, be a thoroughly-protected, iron-cased ship, in every way fitted for foreign service, although of about 2,000 tons' burden only. Vessels of much smaller tonnage than the *Favorite*, completely protected with armour, and adapted for foreign service, are about to be laid down, in conformity with designs prepared by Mr Reed, in concert with the Admiralty, to take the place of our existing unprotected sloops and gunboats about to become obsolete.

The Lords of the Admiralty at Plymouth.—After inspecting the dockyard, they entered the steam yacht *Alice*, and, accompanied by Port Admiral Sir Houston Stewart and the Lord Chancellor, landed shortly after 3 o'clock on the Breakwater. His Grace was received by Mr Neville, superintendent; Mr Hutton, resident engineer; and Mr Ormiston, engineer of the Shovel Rock Fort. Their Lordships inspected the new buttress work in progress and the site of the fort. The total number of men now employed on the breakwater is about 100. The work in progress consists in placing three courses of granite buttress work, dovetailed horizontally and vertically at the foot of the limestone casing, on the outer side, founded at the level of three feet below low-water ordinary spring tides. Of this 4728 lineal feet were completed by the 1st of August, leaving 713 lineal feet still to be formed. Lighters are employed conveying rubble limestone from Oreston quarries to form a foreshore on the south side. The total quantity of limestone and granite deposited to the 1st of August was 3,930,308 tons. The annual expenditure now is about £9500, and it will require some £20,000 to complete this work. The central arm of the Plymouth breakwater is 1000 yards long, the eastern and western arms, which incline towards the harbour, are 350 yards each. The inner part of the foundation of Shovel Fort will be about 32 yards from the outer base of the middle of the central arm. The fort is to be of elliptical form, 160ft. by 130ft., the longer axis parallel to the breakwater. The hearting of the foundation will consist of blocks of manufactured concrete, cased from the bottom up to 6ft. under low water with granite. Above this level the work will be solid and water-tight, and will include tanks for fresh water and magazines for ammunition. The contract for the work is taken by Messrs. Lee, and is under the local direction of Mr Ormiston, C.E. All the piles, 70ft. long, are driven 7ft. into the rock, and a large portion of the staging is fixed. The foundation-stone will be laid on the birthday of the Prince of Wales. The first stone of the breakwater was dropped on the 12th of August, 1813, the birthday of the Prince Regent.

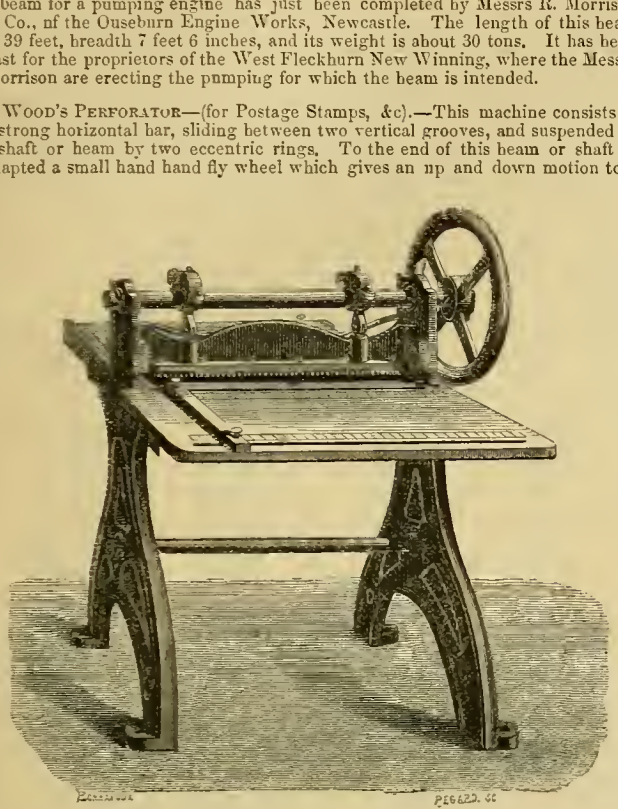
Preserving the Bottoms of Vessels.—In order to test the relative value of certain compositions for preserving the bottoms of iron ships, the Lords of the Admiralty have given directions to use the bottom of the iron steam tank vessel *Minx*, at plymouth, for that purpose. A portion, 40 feet broad, extending from the bends to the keel, is to be divided into four sections of 10 feet each, on which will be applied the compositions of Mr Haycs, the Queen's chemist, Portsmouth: Mr Finnemore, chemist, Plymouth; Mr Elsworth; and Mr Edwards, Assistant-Master-Builder of Devonport dockyard. The *Minx* is employed in supplying water to the Channel fleet. At the end of three months her condition is to form the subject of a special report by some competent Government authority.

Iron Ship Building on the Humber.—On Monday afternoon a large iron steamer was launched from Messrs C. and W. Earle and Co.'s iron shipbuilding yard, Victoria Dock. At the moment of launching the vessel was christened the *Dido*, and is built for Messrs Wilson, Sons, and Co., of this port. She is a large and magnificent vessel, and looked remarkably well on the water. She is to be commanded by Captain Elder, and is intended for the St Petersburg trade in the summer, and the Mediterranean trade in the winter. The following are the dimensions of the *Dido*:—Length over all, 290 feet; length of keel, 268 feet; breadth, 30 feet 6 inches; depth of hold, 21 feet; tonnage, 1,500 tons register, with a carrying power of 2,000 tons. She will be fitted with two engines of 120 horse power each, manufactured by Messrs Earle, and combining all the latest improvements. She is to be rigged with four masts, but we believe will carry no yards. There are at present building in the same yard two large vessels for a Liverpool firm, and one for a Manchester house. Messrs Samuelson and Co. have also on hand several large steamers, also some tug

steamers of a pnwerful class for Liverpool. Shipping is arriving rapidly, and things are assuming a more cheerful aspect.

Monster Beam for a Pumping Engine.—A large and very fine casting of a beam for a pumping engine has just been completed by Messrs R. Morrison & Co., nf the Ouseburn Engine Works, Newcastle. The length of this beam is 39 feet, breadth 7 feet 6 inches, and its weight is about 30 tons. It has been cast for the proprietors of the West Fleckhurn New Winning, where the Messrs Morrison are erecting the pumping for which the beam is intended.

Wood's Perforator—(for Postage Stamps, &c).—This machine consists of a strong horizontal bar, sliding between two vertical grooves, and suspended to a shaft or beam by two eccentric rings. To the end of this beam or shaft is adapted a small hand hand fly wheel which gives an up and down motion to a



horizontal bar to which is fixed the stamper, which consists of a number of small steel punches. A piece of copper, perforated with holes corresponding to each punch, is laid on the table, a piece of paper is laid on the copper, and hy turning the handle of the small fly wheel, a series of small holes will he made in the paper.

Statue to the Inventor of the Mules.—Samuel Crompton, or at least his memory, has at last received a substantial and enduring acknowledgment of his immense practical services to the industrial progress of the country, in the invention nf the cottnn spinning mule. Bolton-le-Moors has erected a brnnze statne nf the illustrions inventor in Nelson Square in that town, and it was inangurated the other day by the usual formalities, including a procession of 12,000 persons. This procession was three miles in length, and included twn hnndred carriages. The cost nf the statue was £1800. Crompton's only snrviving snn, a man of the ripe age of seventy-four, was present at the inaugnratinn.

New Stain for Wood.—M. Em. Monnier recommends the following method for dyeing wond nf a rnse colnnr hy chemical precipitation:—A bath, A, is prepared with 80 grammes of iodide of potassium per litre of water; and a hath, n, in another vessel with 25 grammes of bi-chloride of mercury. The wood tn he dyed is first put into the bath A, where it is left for several hours; it is then dipped into the hath B, when it assumes a beantiful rose colour. The wood thus dyed is afterwerds varnished; the baths will last a long while without any necessity for renewal.

Cure for Diseased Trees and Shrubs.—M. Payen recommends the following:—As soon as it is perceived that the leaves are turning yellow the earth mnst be dng np all rnnnd the root within the space of a metre and a half from the stem, and the roots are then watered, twice on the first, and once on the following day, with a solntion nf 525 grammes of sulphate of iron, 500 of common salt, and 525 nf alum in 40 litres of water. This treatment will instil fresh vigour into the sound roots, cornde the bad ones, and restore the health to those which were abont to be attacked.

Rectification of the Electric Light. — A French investigator, M. Brachet, has suggested the inclosure of the electric light in a duplex glass globe, the inner one of uranium glass to arrest the purely chemical rays, whilst the outer one is nf a colour which will absorb the greenish tones of the light transmitted through uranium M. M. Rognault and Babinet have taken np the subject at the instance of the Academy. The readers of the *Practical Mechanic's Journal* will remember that Mr Burleigh proposed the use of differently colonred glasses for the same purpose for ordinary lights many years ago, and of which we gave the descriptive particulars at the time.

The Sewing Machine.—It is calculated that one machine, with a good operator, is capable of doing as much work as a dozen hands; hence the saving of labour is enormous. Its value to the United States, where wages are high, is greater than to this country, and its amount, according to recent calculations, is really startling. The annual saving to the city of New York alone, on men's and boys' clothing, is not less than £1,500,000; on hats and caps, £92,500; on shirt fronts, £168,750. On boots and shoes in Massachusetts alone, £1,500,000, and throughout the States an aggregate saving of £70,000,000 annually is said to be the result of the sewing machine. There is scarcely a manufacture in which the needle was formerly used which does not now employ these machines; and there is scarcely a household in which it does not drudge for the family welfare. They are counted in the States, in fact, by hundreds of thousands.

Cotton Manufactures.—The astounding development of the British cotton manufacture of late years probably surpasses the conceptions generally formed on the subject. Thus, the value of the cotton goods exported in 1843 was £16,254,000, and of the cotton yarn £7,193,971. Three years later, in 1846, the totals had risen to £17,717,778 and £7,882,048 respectively; in 1849, to £20,071,046 and £6,704,089; in 1852, to £23,223,432 and £6,654,655; in 1855, to £27,578,746 and £7,200,395; in 1858, to £33,421,843 and £9,579,478; and last year, to £42,141,500 and £9,870.875. In the first half of the 18 years the value of the exports of cotton goods was in round numbers £230,000,000, and in the second half £340,000,000, showing an increase of nearly 48 per cent. in the latter period over the former. In the next 20 years, at this rate of increase, Lancashire will receive as much for her products as would pay off the national debt. It is worthy of remark that, while the value of the goods exported appears to have increased during the last nine years 48 per cent., the quantity of the raw material imported has increased 58 per cent., the difference being probably accounted for by increased domestic consumption.

Fatal Accidents in Coal and Ironstone Mines.—From the reports of the Inspectors of Mines, which have just been printed by order of Parliament, we learn that the total number of accidents in the coal and ironstone mines of Great Britain during the year 1861 was 811, as compared with 797 the preceding year, being an increase of 42. Of these, 39 occurred in the eastern district of Scotland, and 36 in the western district of Scotland. In the collieries of the eastern district there were 3 explosions of fire-damp, 10 accidents caused by falls of coal, and 12 by fall of the roof of the mine, 5 accidents in shafts from various causes, 3 underground, and 6 on the surface. In the western district there were 4 explosions of fire-damp, 21 accidents caused by falls in the mine, 7 in shafts, 1 underground, and 3 on the surface. Mr Alexander, the inspector for the western district, estimates the gross output of coal from the collieries of that district at 6,100,000 tons. The number of deaths caused by the accidents in these collieries was 37, or 6 per million tons of coal raised. The output of ironstone is estimated 1,700,000 tons, and the number of deaths by accidents was 13, or 7·6 per million tons of ironstone raised. The larger proportion of deaths in ironstone mines is accounted for by the fact that ironstone is more difficult to work, independent of the large proportion of rubbish which requires to be taken out, in some cases greatly exceeding the weight of the ironstone, whereas in working coal-seams there is generally sufficient space at a convenient distance underground for stowing purposes, and very little rubbish requires to be drawn to the surface. "The statistics of ironstone mines," says the inspector, "are yet incomplete, but further experience will probably prove that coal mining is a more hazardous occupation than ironstone mining in proportion to the number employed and the work performed." For the past year the loss of life from the destructive effect of fire damp has been considerably reduced. The accidents from falls of coal and roof in the western districts of Scotland are exactly the average of the last six years.

Coal and Coke Supply to the Metropolis.—The quantity of coal and coke carried to London during the month of September shows a considerable increase on the same month of last year, but a decrease so far as the nine months of the year are taken into account. The London and North-Western conveyed 66,422 tons 17 cwt. coal; Great Northern, 31,191 tons 16 cwt.; Midland, 23,200 tons; Great Eastern, 11,071 tons 9 cwt.; Great Western, 10,339 tons; South-Western, 1,521 tons, 13 cwt.; South-Eastern, 1,108 tons 10 cwt.; Chatham and Dover, 250 tons 2 cwt.; Tilbury and Southend, 76 tons; total, 145,181 tons, 7 cwt., against 127,243 tons 2 cwt. for September, 1861. The tonnage by canal is 1,098 tons 10 cwt., against 841 tons 5 cwt. for the same month of last year. Up to this time for the nine months of 1862 1,05.,224 tons 16 cwt. of coal have been carried by railway, against 1,208,040 tons 13 cwt., or a decrease of 155,815 tons 17 cwt. The canals show a decline from 14,025 tons 15 cwt. in 1861 to 9000 tons 5 cwt. Of seahorne coal, &c., there have been from Newcastle, 95,855 tons; Hartlepool, and West Hartlepool, 47,360 tons; Sunderland, 72,422 tons; Seaham, 15,593 tons; Middlesborough, 5,542 tons; Blyth, 1,688 tons; Scotch, 1,372 tons; Welsh, 14,092 tons; Yorkshire, 2,616 tons, Duff, 379 tons; small, 2,218 tons; and cinders, 1,062 tons; altogether, 260,199 tons, as compared with 292,814 tons, for the same month of last year. Up to this time in 1862, we have had 2,467,614 tons in 7,576 ships, as against 2,579,972 tons in 7,845 ships for the same period in 1861, being a diminution of 269 ships and 112,358 tons.

The Zodiacal Light.—This phenomenon, to which M. Faye has recently called the attention of the French officers now in Mexico, consists of a cone of whitish light, having the sun for its base, and generally perceptible at sunrise and sunset during the equinoxes. In our latitudes it is of rare occurrence, but the nearer we get to the equator the more remarkable is the splendour of the phenomenon. Within the tropics it is almost permanent. The most singular theories have been imagined to explain the appearance of this cone in the heavens. Some have considered it a kind of perspective projection on the celestial canopy of one or more rings of cosmical matter circulating round the sun, much in the same way as Saturn's rings revolve around that planet. These imaginary rings are believed to lie within the orbit of the earth, but very

near to it. M. Biot saw in the zodiacal light a permament manifestation of one or several rings of shooting stars and aerolites. M. de Tessan, having remarked tbat the point of the luminous cone was often at a distance of from 90 to 100 degrees from the sun, concluded that this point lay far beyond the terrestrial orbit. According to others, the zodiacal light is simply an immense solar atmosphere, strongly depressed of a lenticular form, and constituting the matter which feeds the suu. This is the theory of Messrs Mayer, Waterton, and Thomson. Others again consider tbe phenomenon to he purely terrestrial —a view of the case which does not exactly agree with the iuclined position of the zodiacal light, although the earth's atmosphere has been proved to extend much higher than the fifteeu league's formerly assigned to it. Lastly, the Rev. G. Jones, of the United States, imagines the zodiacal light to be owing to the existence of a very thin ring of nebulous matter circulating round the earth and within the orbit of the moon. Which of all these views is the true one, further observation will decide.

Japanese Plants.—Tbe *Bulletin de la Société d'Acclimatation* of last month, contains the second part of a letter from M. Eugène Simon, writing from Japan, aud the first part of which we noticed about a month ago. M. Simon, in this second part, recommends the cultivation of the hemp-palm *(Chamærops excelsa)*, brought over into Europe about 30 years ago hy Dr Sieholdt, but hitherto confined to hotanical gardens. This species of palm-tree would thrive very well in France, since it will bear a temperature of 10 degrees Fahrenheit. It requires no partieular care; the stalk of each leaf is covered with filaments of various fiueness; the coarsest are used for ropes, the fiuer sort for uets. Every second year the leaves are cut oft close to the trunk, except a few which are left on the top; the filaments are separated and packed into hales of 25 kilogrammes each. The price of this commodity varies from 50f. to 70f. per 100 kilogrammes. Each tree will yield from four to five kilogrammes. Another plant meutioned by M. Simou is the *soja*, a kind of hean, used in Japan for a coudiment, which is manufactured on a large scale at Nagasaki and other places, and is sold at the ratc of ahout 17f. per jar, weighing 214½ kilogrammes. To prepare this condiment the heans are hoiled, and then mixed with roasted barley. When the dough thus ohtained has become perfectly uniform by stirring, it is put into moulds 1½ inch in height, and 18 inches hy 8 at the hase. The cakes so made are left to ferment for a week in a close room, when they acquire a uniform golden hue. They are then throwu into large vats, and lime water is added in the proportion of two kilogrammes for every kilogramme of cakes. After stirring a good deal, the vats are then left to themselves for at least a twelvemonth; the substance contained in them is then put into canvass bags, and subjected to the actiou of a press. A syrupy liquid oozes out, which is *soja* of the first quality; of the residue an inferior quality is made for the poor. It is used in almost every Japanese dish, is very savoury, and particularly well adapted to fish.

Substitute for Cotton.—Tbe new fibre, about which so much mystery has recently heen made, as being a cheap substitute for our staple textile material, turns out, after all, to be merely sea-weed. The inventor, a Mr Harben, is, naturally enough, intensely sanguine ahout it, just as scores of enthusiastic, but short-sighted, investigators have been before. But to tell the truth plainly, *all* sea-weeds have heen tried over and over again without any good result, and Mr Harben has really contributed nothiug to our knowledge of textile materials. There is no such tbing yet known as a "substitute" for cotton. The *Zostera Marina*, like many other marine plants, furnishes a good, flexible fibre; but it is not a substitute for eotton. It occupies, as all other fibres of its family do, a positiun hetween flax or hemp, and cotton. It is neither so strong and practically workable as the one, nor so fine nor so generally applicahle for textile purposes as the other. Besides this, the proportion of useful fibre to the bulk of the plant is very small; and more than this, the supply, whatever may have been said by too sanguine people to the contrary, is limited. Taking every atom of sea-weed which the British Islands could furnish, the aggregate would he but a mere drop in the ocean as compared with cotton, which, besides, is given to us in a condition fit for immediate use, with the simple exception of the removal of the seed, whilst all marine plants, like flax, demaud an expensive preparatory process for *making*, as it were, tbe fihre. Tbe proposed marine fihre will, no douht, he valuable for a mixture with other materials, so long as cotton remains as it is. But its use will end here, or, at most, it will merely proceed further as an article for the manufacture of special classes of fabrics. The present dearth of cotton cannot last for ever. We shall he constantly extending what we may term our cotton farms; and more than this, the American turmoil will end some day, and then the original growers will he glad enougb of British money in exchange for what they can produce so easily. No matter whence the cotton comes, we are persuaded that if we are to preserve our supremacy in cheap and universally available textile manufactures, cotton we must have for the purpose, and to cotton must we again return.

Spectrum Analysis—Chemical analysis by the agency of the spectrum has just received a practical impulse of value from Herr Plücker of Bonn. He shows:—1. That the spectra of gases or vapours vary with the power of the apparatus wbich causes the current to pass tbe tube containing the gases, and that the spectra show a tendency towards continuity hy the spreading of the rays. 2. He proves that this variahility and this spreading are eaused by the elevation of temperature, which determines the increase of the power of the coil of induction, so that the number and nature of the rays of the spectra of gases and vapours are due to the temperature to whioh they are submitted in the capillary tubes. And he shows, 3. How, by augmenting the density of gases and vapours, previously higly rarified, at the same time increasing the power of the apparatus and submitting the gases and vapours to a temperature more and more elevated, there may he made to appear the brilliant or sombre rays which characterise their constituent principles, alternately separated and reunited by the dissolving and combining power of heat. For example—If he passed the current of induction of the large apparatus of Ruhmkorff over a very fine short capillary tube containing hydrogen at a tension of about half an atmosphere, he obtained a spectrum analogous to that obtained from a small apparatus of induction when the gas was highly rarified; hut if he interposed a Leyden jar to increase the energy of the current the spectrum suddenly changed its aspect. The violet and hlue lines did not spring as before from the ground, now become hrilliant; and he saw only at one end of the spectrum the red band become larger, with a hrilliancy surpassing that of the adjacent part. When he directed the spectrum apparatus over the hroad part of the tube surrounding the electrode, where the light, before entering the capillary tuhe, is less conentrated, an intermediate phenomenon was presented. He saw around the continuous spectrum the three primitive lines; hut the red line alone remaiued as it was hefore, while the two others were expanded, the violet more than the blue. Tbe spectrum of oxygen is weak wheu ohtained in the usual way; but with the tension of about 100 millimetres it gives, when a powerful induction apparatus and tbe Leyden jar are employed, a spectrum composed of the most heautiful lines of refrangihility. Similar changes occur with the spectra of nitrogen, chlorine, &c. M. Plücker also states, that by his method glass tuhes open at hoth ends may be employed instead of those hermetically sealed, and considers that grand results my be expected from this mode of "spectrum analysis."

The Stock of Cotton.—Tbe large receipts of Surat cotton at Liverpool of late have had the effect of greatly increasing the estimated stock on hand which is happily now larger than at any previous period during the present half-year. Thus the weekly course of affairs has been as follows during the last 14 weeks, as compared with the correspouding season in 1861 and 1860:—

Stock.	1862. Bales.	1861. Bales.	1860. Bales.
July 4	184,940	1,108,300	1,298,490
" 11	156,980	1,101,730	1,227,990
" 18	155,490	1,053,710	1,287,520
" 25	171,430	1,001,090	1,283,230
Aug. 2	161,500	1,010,100	1,241,370
" 9	158,750	969,940	1,203,740
" 16	125,310	944,360	1,157,590
" 23	82,420	912,130	1,128,210
" 30	62,930	837,120	1,093,200
Sept. 5	58,150	886,680	1,022,370
" 12	92,230	868.260	941,810
" 19	90,630	818,200	955,270
" 26	84,510	751,500	903,200
Oct. 3	212,590	712,830	834,650

The ordinary eourse of the trade is thus being completely reversed, for while in September and October the stock usually declined, it has this autumn increased. The present consumption and export demand cannot be said to exceed 25,000 hales per week; and, as the foregoing estimate sbows a stock of 212,590 hales on hand at the close of last week, while in many quarters it is affirmed that the total should he given at 250,000 or 300,000 hales—as, too, 271,000 hales are estimated to he still at sea from India, and from 5,000 to 10,000 hales will, no doubt, continue to drop in weekly from other quarters, the prospects of the supply certainly look more hopeful than for some time past, notwithstanding the ohstinate continuance of hostilities in the American States.

Tne following table shows the enormous rise in price which the present state of affairs in America bas eaused:—

Raw Cotton.	Price Oct. 9, 1862.	Price Oct., 1861.	Price Oct, 1860.	Price Oct., 1859.	Price Oct., 1858.
	s. d.	s. d.	s. d.	s. d.	s. d.
Upland fair, ... per lb.	2 5	1 0	0 7 1/8	0 7 1/4	0 7 5/8
Do. good fair, ...	0 0	1 0	0 7 1/2	0 7 1/2	0 7 3/4
Pernambuco fair, ...	2 2½	0 11 7/8	0 8 1/2	0 8 3/4	0 8
Do. good fair, ...	2 3	1 0	0 8 3/4	0 9 1/4	0 6 7/8
No. 40 mule yarn, fair, 2d qual., ...	2 6	1 1½	1 0	1 0 1/4	1 0 3/4
No, 30 water twist do.	2 7	1 1 1/4	0 11 5/8	1 9 1/4	0 11
26-in., 66 reed, printer, 29 yds., 4 lh. 2 oz.	11 0	6 1½	5 7½	5 9	5 3
27-in., 72 reed, do. do. 5 lb. 2 oz.	12 6	7 1½	6 4½	6 6	6 1½
39-in., 60 reed, gold end shirtings, 37½ yards, 8 lb. 4 oz., ...	18 0	10 0	9 6	9 1½	9 4½
40-in., 66 reed, do. do., 8 lh. 12 oz.	19 6	11 0	10 6	10 4½	10 3
40-in., 72 reed, do. do., 9 lh. 4 oz., ...	21 6	12 3	11 9	11 9	11 0
39-in., 48 reed, red-end long cloth, 36 yards, 9 lh., ...	17 9	9 3	8 9	8 9	8 10½

Imports, Exports, Consumption, &c., from 1st January, to 9th October.

Whole Import.		Consumption.		Exports.		Computed Stock Octoher 9.	
1862.	1861.	1862.	1861.	1862.	1861.	1862.	1861.
Bales	Bales	Bales	Bales	Bales	Bales	Bales	Bales
882,247	586,327	964,400	1,895700	345,260	511,260	195,150	675,050

Wrought Iron Lattice Girder Bridge for India.—Messrs Ormerod, Grierson, & Co. of the St George's Ironworks, Hulme, Manchester, have just completed the third span of a huge wrought-iron lattice girder bridge for a railroad and carriage-way combined, which is intended to cross the river Jumna, near Delbi. The bridge is for the East India Railway Company, and is from the designs of Mr A. M. Rendel, C.E. If our readers will imagine an iron tube,

with solid top and bottom, with open cross lattice-work sides, through which air and light can freely pass; that this tube is over half a mile long, 18ft. high by 18ft. wide, with a clear space of 16ft. from the level of the highway for carriages and pedestrians to the under side of the railroad above, they will be able to realise the extent of this colossal structure. Its entire weight will be about 3,400 tons, and when delivered at Liverpool for shipment to India, it will have cost more than £50,000. The bridge will be composed of 12 girders, each 216ft. long, supported at each end by stone piers, 205ft distant from each other. Each span has a rise of 5in. in the centre. The top and bottom parts of the girders resemble a continuous trough, the upper pair being inverted. The bottom of this trough has one plate ⅝in. in thickness, the strength gradually increasing to three plates of the same size, at the centre. The sides of the trough are composed of two ½in. plates, riveted together; and instead of being joined to the bottom plates in the usual way with angle iron, they are flanched, or bent to a curve of 4in. radius, thus forming their own attachment. This method of construction considerably improves the appearance of the work, without detracting from its strength. In a structure of such magnitude, and which will be exposed to the intense heat of an Indian sun, it is of the greatest importance that due provision be made for variation of expansion and contraction. This provision has been secured by a simple arrangement which allows the end of each girder to slide on rollers with perfect certainty and ease; while by the same apparatus the varying deflections are also provided for. During the progress of construction every portion of the work is carefully noted by an official inspector, who rigidly rejects any plate or other portion of work in which the least flaw can be detected, thus insuring, so far as the engineers are concerned, first class materials and excellent workmanship. All the parts of the structure are so fitted by planing and other self-acting tools, that great ease of construction has been secured when the work is being put together, giving also the advantage of little trouble in joining the parts on their arrival in India. The drilling machines for boring the plates are fine specimens of that class of tools. One of them will drill at one time 160 holes one inch diameter in a plate 13ft. long, 4ft. broad, by ⅝in. thick. The pressure on the drills by the movement upwards of the table supporting the plate, is regulated by two small valves which act upon two hydraulic-rams.

Reducing Metals.—The amalgam of sodium as an agent for reducing metals is beginning to attract attention. Mr Ch. W. Vincent has obtained an amalgam of chromium by introducing that of sodium into a solution of chloride of chromium, and by subsequent distillation in a retort filled with naptha vapour, the chromium itself is obtained in a finely divided state. Mr W. B. Giles also has decomposed a saturated solution of pure protochloride of manganese by the amalgam of sodium, whereby an amalgam of manganese was obtained. The mercury of the latter being driven off by the application of heat, there remains a brownish-black powder, which appears to be manganese.

Railway Rolling Stock.—The number of locomotives on railways in the United Kingdom at the close of last year was 6,156—viz., 4,956 in England and Wales, 848 in Scotland, and 352 in Ireland. At the close of 1860 there were 4,696 engines in use in England and Wales, 781 in Scotland and 324 in Ireland,—making a total of 5,801, as compared with 6,156 at the close of 1861. The number of passenger carriages, trucks, &c., in use on lines in England and Wales amounted at the close of 1861 to 171,475, as compared with 162,915 at the close of 1860; in Scotland to 31,131 at the close of 1861, as compared with 27,091 at the close of 1850; and in Ireland to 6,363, as compared with 5,644 at the close of 1860—making a total for the United Kingdom of 208,969 passenger carriages, trucks, &c., at the end of last year, as compared with 195,650 at the close of 1860. The mileage in operation increased from 10,433 miles at the end of 1860 to 10,869 miles at the close of 1861.

Manual Locomotion on Common Roads.—We thought that, for all practical purposes, manumotives, pedomotives, and velocipedes, had positively died out in our days, but it seems that they still flourish, at least in Bristol they have found a home. An ingenious Mr Harris of that place, is the constructor of a "velocipede," as it is termed, although, without knowing much about its details, we suspect that "mann" or "pedo" would be only proper adjuncts for its designation, and on board this conveyance the maker and his brother determined to go and see the International Exhibition. The distance is 108 miles, and this they accomplished in 21½ hours. The return journey—after a three days' stay—was effected in 18 hours. This, it is said, was accomplished without any distress. Such a journey is, we should say, without anything approaching to a parallel.

Products of the Mohee.—Mr Hayes has sent in a paper to the Société d' Acclimatation, recommending the introduction of the Illoopay plant (*Bassia longifolia* and *latifolia*) into Algeria. This plant, well known in the presidencies of Madras and Bombay under the name of *Mohee*, and in Bengal under that of *Moolah*, is remarkable for the aromatic alcohol obtained from its blossoms by fermentation. The seed contains about 30 per cent. of its weight of a kind of oil, which is always in a solid state, and may be advantageously applied to the manufacture of candles and soap. The tree grows wild in India, constituting about one-sixth of the forests which lie in a line between Calcutta and Bombay. Its wood is as hard as teak, but not quite so durable.

Cotton in Queensland.—As an encouragement to the cultivation of cotton in Queensland, by regulations dated August 1, 1861, any person or company, by depositing in the Colonial Treasury at the rate of 2s per acre, may obtain the occupation of a block of land not less than 320 nor more than 1,280 acres. If within two years one tenth of the land has been planted with cotton, and at least £5000 to each 640 acres been expended in cleaning, fencing, cultivation, or improvements connected with cotton-growing, the deposit of 2s an acre will be returned, and a grant in fee issued to the occupant. On failure of these conditions, the land, the deposit, and all improvements are forfeited, or if the cultivator has proceeded to half the above requirements the land may be saved on payment of £1 per acre for the portion unimproved, but the whole deposit of 2s will be forfeited. No application under these regulations will be received after the 10th of August, 1863. As a further encouragement to the growth of cotton, the Governor in Council may issue land orders during the three years next after the passing of the Act to the extent of £10, and during the two following years to the extent of £5 for every bale weighing 300lb. of good clean Sea Island cotton, not damaged or discoloured, grown in the colony exported to Great Britain. One-half of these premiums are to be given for the common description of cotton.

Can Sponges be Transplanted and Acclimatised.—The *Société d' Acclimatation de Paris* is just such an institution as we want in this country. It is true that to Kew and the Botanical Society we owe a pretty heavy debt, incurred in attempts at acclimatization; but such efforts are necessarily of a desultory nature, and it is clear that Britain will not do justice to herself until she adopt the French system, and perfects an independent system of acclimatization of her own. The many excellent results which have been brought about in France are of themselves a sufficient stimulus to special exertions in the same way here; and we hope yet to see the same principle carried out in its fullest integrity on our soil. One of the most recent, and certainly the most important, of the researches undertaken by the Parisian Society, is that in reference to sponges. M. Lamiral, who departed for the coast of Syria with a view to obtain sponges for transplantation, has now returned, and presented a detailed report of his proceedings to the Société d'Acclimatation. M. Lamiral distinguishes three kinds of sponges for which there is a demand—the fine and soft sponge, called *abiand;* the fine and hard sort, called *achmar;* and lastly the common sort, called *cabar* by the Arabs. These sponges are found in the Levant within the 36th and 33d degrees of latitude—that is, between Alexandretta and Saida. It is now universally acknowledged that sponges belong to the animal kingdom, and are an aggregate of cellules built up by gelatinous polypi similar to those which construct madreporæ, porites, and other polypifers. When the sponge is first gathered at the bottom of the sea, it is covered with a black but transparent gelatinous substance, resembling vegetable granulations, among which microscopic white and oviform bodies may be distinguished. These are the larvæ destined to perpetuate the species. When arrived at maturity, they are washed out by the sea-water which incessantly flows through the sponge; they then swim along, by the aid of the vibrating cilia or hairs with which they are provided, until they reach a suitable rock, to which they attach themselves, and there commence a new life. This emigration of the larvæ from the parent sponge occurs about the end of June and beginning of July. The fine qualities of sponges are chiefly found at a depth of fifteen fathoms or thereabout; the common sponge lies at depths varying between twenty and thirty fathoms. At Tripoli (on the coast of Syria, not of Africa) M. Lamiral engaged some divers, who commenced operations on the 21st of May. The sponges gathered were immediately placed in boxes, through which a stream of sea-water was constantly made to flow, the animal matter being, of course, left on them, and protected from injury. These sponges arrived at Marseilles on the 17th of June; thence they were taken to Toulon and the island of Hyères, where stone troughs, with five sponges in each, were sunk in different places. The success of the experiment will not, of course, be known until next season. M. Simon, also working on behalf of the Society, recommends the cultivation in our climate of the hemp palm *(Chamdross excelsa).* This plant will bear a temperature of 10° Fah., and it is therefore urged that it would do very well with us, particularly as its cultivation demands no particular care. The stalk of each leaf is covered with filaments of various degrees of fineness—the coarsest being used for ropes, and the finest for nets. The price of the fibre varies from twopence to threepence per pound. M. Simon also mentions as a most useful plant, the *Soja*, a species of bean, used in Japan as a condiment. The produce is sold in and about Nagasaki, in jars at about a halfpenny per pound. To prepare this condiment, the beans are boiled, and then mixed with roasted barley. This produces a dough which is moulded into cakes, and these are set to ferment in a close room. After this the cakes are thrown into vats, with the addition of lime water. The mixture is then stirred about, and after standing for a year, the mass is placed and pressed in bags, when a syrupy liquid exudes, and this is the *soja* of the first quality—the residue produces an inferior sort. *Soja* is used in most Japanese dishes, and it is said to be a really good article of food.

A complete squadron of line-of-battle and other steamers are now being brought forward at Chatham and Sheerness for the steam reserve on the Medway. The ships include the *Conqueror* (late the *Waterloo*), 101 guns, 800-horse power; the *Anson*, 80, 800-horse power; the *Leander*, 51, 500-horse power; the *Terrible*, 21, 800-horse power, paddle-wheel steamer; the *Pylades*, 21, 350-horse power; the *Jaseur*, 5, 250-horse power; and the *Carnation*, 2, 80-horse power. The whole of the above will be fully equipped for sea, and placed in the first-class steam reserve, in readiness to proceed to sea within a few days after receiving their respective crews.

An important and what promises to be a most valuable invention for economising both time and labour in the plating of iron and armour-cased vessels, the invention of Mr Matherson, of Devonport dockyard, having been submitted to the Admiralty and most favourably reported upon, Mr Hutchens, one of the assistant-master-shipbuilders at Chatham dockyard, who superintended the construction of the *Warrior*, has been ordered to proceed to Devonport for the purpose of examining it, in order to ascertain whether it should be generally adopted in the Royal dockyards. The machine, when screwed up to the ship's bottom or side, takes an exact impress of the mould for the armour plate. Another machine, also invented by Mr Matherson, bends the plates to exact shape of the mould, within the fraction of an inch—a degree of accuracy impossible to be obtained under the prescut plan of shaping and bending the armour plates.

Granite Quarrying and Polishing.—Quarrying consists in the proper severation of blocks from the parent rock. This is a matter of discernment and long lahour. The usual way is to drill a vertical hole into the mass, to the depth of 10 feet to 16 feet, with steel drills. This effected, the bore is charged with gunpowder, the ordinary charge is four pounds; the charge is driven home with an iron rod. Formerly brass or copper rods were used for this purpose, to avoid explosion; hut since the introduction of a patent fusee—a German invention, we have been informed—the iron rod has been used. The fusee resembles a piece of thick twine enclosing the train, which is surrounded hy threads of flax, well tarred, that it is impervious to damp. One end of the fusee is inserted into the charge. The drill into which it is inserted is rammed down well. The charge may he fired in any weather. A mass of rock tumbles into the quarry after the blast—rude as if it had been shot from the moon. The mass is then attacked by "cutters," who make triangular holes in its surface in the direction the stone is required to be cut through. Into these holes, soft iron wedges are driven by the hammers one after the other. The result is, blocks, from the main block of certain proportions. From these blocks the mason fashions curb-stones, paving-stones, and facing-stones for huilding purposes. These stoues are still inchoate. They are in the rudest form. They pass from the quarry into other hands, who dress and trim them to the fineness required. The mason of the quarry is not the mason who prepares ultimately the stone for the building, but the one and the other must understand his work. Dressing for common purposes is effected by means of *picks*, or iron hammers, pointed at each end and tipped with the hardest steel, varying in weight from 10 lbs. to 20 lbs., to adopt them for working on particular qualities of stone, and degrees in the process of dressing. For joints and mouldings the chisel aud puncheon are employed. The command which the workman has over the obdurate primitive rock is surprising to those who witness his operations for the first time. But to understand the whole process of dressing and polishing, one has to visit an establishment such as that of Mr A. Macdonald, of Aberdeen, who has in the International Exhibition (Class I., No. 214) a fine display of specimens of granite used in huildings, decorations, memorials, and for geueral purposes. Mr Macdonald's polishing works are the most extensive in the kingdom, and it was the father of the present proprietor who first applied hand and steam power, and who introduced various contrivances for polishing granite. When the stones are brought from the quarry to the works, there are three travelling cranes to transport them from place to place where they are to be operated upon. The quarrier squares the stone roughly, but there are other skilled hands attending in such works as these to give it a finish. First comes to the rescue of the future architectural or monumental stone the *pick* already mentioned. It chips and hacks the stone to a smoother, flat or round surface. Any surface it leaves in a *knubly* state. It exposes quartz, felspar, and mica in every sort of irregularity. When granite is left in this state, if it do not decay, even in the "granite city," it gets its face blacked, and soon looks very ugly. Finer *picks* reduce the molecules; but we have not yet arrived at fine dressing. Fine dressing is performed by means of chisels for joints and grooves. But the single axe is the great eliminator. The *axe*, called the patent axe, is a tool composed of from six to eight blades, each of one-eighth of an inch in thickness; the whole compactly bound together, and presenting a hewing or "axing" surface of three inches in length. This axe is a modern instrument in stone-hewing in Scotland, having been introduced from America, about thirty-five years ago. It does its work rectilinearly and obliquely, leaving the stone in the finest state of finish that tool can accomplish; the surface, in fact, is smooth as a piece of iron passed over by a file. In this state it is fitted for the finest building purposes; but for the highest decorative purposes this is not quite enough. The last "axing" fits the stone for the polishing machine. For flat surfaces concentrie grinders are applied to the surface of the stone. The sweep of these grinders is not circular, but they imitate the motion of the human arm as nearly as it is possible. Sea-sand is the first grinding medium employed, next emery, and lastly, and for the final polish, the oxide of tin. Large slabs are thus operated upon. Narrow slabs are submitted to an operation almost identical to that employed in polishing plate-glass. That is, the slabs are fixed in a frame, and above them work horizontal planes, charged with sand, and the other polishing materials. In every case the final polish is given by means of the oxide of tin. Columns are rounded hy the mason, smoothed hy the *axe*, and polished in a turning lathe. Grinders, or polishers rather, repose on, and transverse the pillar in the lathe from end to end, fed continually hy polishing matter. The rapidity of the process, and the equal surface given to the revolving mass of granite, excite admiration. Large circular hasins for fountains, granite vases, &c., are submitted to the lathe. The mountings, cut primarily by the chisel, are wrought upon afterwards in the lathe, by cast-iron planes. These planes act not only in curves but in right lines. The result is the most perfect polishing of granite as far as simple geometric lines are concerned. Certain convex and concave granite articles, such as drinking-fountains, volutes, &c., are first finished hy the axe and afterwards polished off hy the hand. The same remark applies to ornamentation, such as the foliage of the capital of a Corinthian column. On the whole, one must admire the machinery which has been brought to bear on a primitive rock iu order to fashion it into commendable shape. There are saws, for example, to cut granite into slabs of the desired thickness. A dozen saws may he employed upon the same block. These saws and the various polishing machines are worked hy an engine of forty horse-power. The obduracy of the granite is shown in the fact that the frame saws out a block at the rate only one-eighth of an inch in a day of ten hours. The single heavy saw cuts out at the rate of an inch a day, and thus it would require twelve days to cut through a granite block twelve inches in thickness.—*Building News.*

Colliery Accidents.—The reports of the Government Inspectors of Mines have just been made up, and show that mining accidents unfortunately increased last year as compared with 1860. The number of fatal accidents from explosions of firedamp was 61 in 1861, and 70 in 1860; from falls of coal and ironstone, 156 in 1861, and 140 in 1860; from falls of roof, 257 in 1861, and 239 in 1860; from overwinding, 6 in 1861, and 4 in 1860; from ropes and chains breaking, 7 in 1861, aud 12 in 1860; from casualties occurring while ascending or descending shafts, 40 in 1861, and 34 in 1860; from matters falling into shafts from the surface, 5 in 1861, and 6 in 1860; from matters falling from parts of the way down shafts, 22 in 1861, and 32 in 1860; from miscellaneous casualties in shafts, 19 in 1861, and 21 in 1860; from explosions of gunpowder, 14 in 1861, and 9 in 1860; from suffocation hy gases, 10 in 1861, and 7 in 1860; from irruptions of water, 4 in 1861, and 2 in 1860; from falling into water, 0 in 1861, and 4 in 1860; from casualties by trains, inclined planes, &c., 72 in 1861, and 79 in 1860; from underground machinery, 4 in 1861, and 5 in 1860; from miscellaneous casualties underground, 19 in 1861, and 10 in 1860; from surface machinery, 22 in 1861, and 23 in 1860; from hoilers bursting, 2 in 1861, and 3 in 1860; from miscellaneous surface casualties, 42 in 1861, and 22 in 1860; making a gross total of 811 in 1861, and 769 in 1860. Dividing the aceidents into five great classes, the following more general results may he arrived at:—Accidents from explosions of firedamp, 61 in 1861, and 70 in 1860; accidents from falls in mines, 413 in 1861, and 379 in 1860; accidents in shafts, 148 in 1861, and 157 in 1860; accidents underground, 123 in 1861, and 115 in 1860; accidents on surface, 66 in 1861, and 48 in 1860. The proportions in which the 811 fatal mining accidents of last year occurred were as follows in the various districts into which the kingdom is divided for purposes of official inspection:—Northumberland, Cumberland, and North Durham, 95; South Durham, 75; North and East Lancashire, 67; West Lancashire and North Wales, 78; Yorkshire, 65; Derbyshire, Nottinghamshire, Leicestershire, and Warwickshire, 43; North Staffordshire, Cheshire, and Shropshire, 41; South Staffordshire and Worcestershire, 115; Monmouthshire, Gloucestershire, Somersetshire, and Devonshire, 66; South Wales, 91; East of Scotland, 30; West of Scotland, 36. These details refer, it will he seen, to both coal and ironstone mines. With regard to coal mining more particularly, it appears that in the five years ending Dec. 31, 1860, 380,467,047 tons of coal were raised in Great Britain, and that 5,095 lives were sacrificed in obtaining them. Thus every 74,674 tons of coal made availahle for consumption cost a human life!

Iron-cased Ships.—The following is a list of all our iron-cased ships and floating batteries, building or afloat:—

Name	Horse power.	Speed in knots.	
Iron Built.—(building.)			
Achilles	1,250	14·1	estimated.
Agincourt	1,350	14·3	ditto.
Minotaur	1,350	14·3	ditto.
Northumberland	1,350	14·3	ditto.
Hector	800	11·75	ditto.
Valiant	800	11 75	ditto.
Prince Albert	500	11·4	ditto.
afloat.			
Black Prince	1,250	14·3	estimated.
Warrior	1,250	14·354	by trial.
Defence	600	11·356	ditto.
Resistance	600	12·331	by trial without stores.
floating batteries.			
Erebus	200	about 5·5	
Terror	200	ditto.	
Thunderbolt	200	ditto.	
Wood Built—(building.)			
Caledonia	1,000	12·4	ditto.
Ocean	1,000	12.4	ditto.
Royal Alfred	800	11·5	ditto.
Royal Oak	800	11·5	ditto.
Favourite	400	10 87	ditto.
Enterprise	160	9.50	ditto.
converting.			
Royal Sovereign	800	12·25	ditto.
afloat.			
Prince Consort	1,000	12.4	ditto.
floating batteries.			
Ætna	200	About 6·0.	
Glatton	150	About 5·5.	
Thunder	150	ditto.	
Trusty	150	ditto.	

Of the iron-huilt vessels, the Prince Albert and the three floating batteries are or are to he, wholly cased with armour plating, the rest partially; of the wood-huilt the Favourite and Enterprise are to be partially cased, the rest wholly. Only the Prince Albert and the Royal Sovereign are to he fitted with Coles's cupolas; the rest with masts.

Progress of Submarine Telegraphs.—A telegraph received lately announces the successful submersion of the first portion of a new telegraph cahle between England and Holland. Owing to the increase in their message traffic between this country and the continent, the Electric and International Telegraph Company entered into a contract with Messrs Glass, Elliot & Co., of Greenwich, for a new line to he laid between Lowestoft and Landvoort. The steamer *Hawthorne* shipped 48 miles of the cahle last week, and the whole was successfully paid out, under the superintendence of the engineers, Messrs Canning & Clifford, and the electricians, Messrs de Santy & Saunders; the electrician of the Telegraph Company, Mr C. F. Varley, being also on hoard. The cahle is the heaviest yet constructed, and contains four conducting wires. The English shore end (15 miles) weighs no less than 16 tons per mile, and is above two inches in diameter. The remaining portion will he shipped immediately.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING OCTOBER 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week			4th week.		
IRON.	£	s.	D	£	s	D	£	s.	D.	£	s.	D.
Bars, &c., British, per ton.	6	10	0	6	10	0	6	15	0	7	10	0
Nail Rods,	7	0	0	7	0	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	5	0
Sheets,	8	10	0	8	10	0	9	0	0	9	10	0
Pig, No. 1, Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	0	0	7	0	0	7	0	0
Rails,	5	7	6	5	10	0	5	0	0	5	0	0
Pig, No. 1. Clyde,	2	11	9	2	12	0	2	16	0	2	15	9
Swedish in hond,	10	5	0	11	10	0	11	0	0	11	0	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	10	0
In faggots,	15	10	0	15	10	0	15	10	0	15	10	0
SPELTER, ingot,	17	15	0	10	17	0	17	15	0	18	17	6
ZINC, sheet,	23	10	0	23	15	0	24	10	0	24	10	0
COPPER.												
Sheathing bolts, pr lb.,	0	0	11	0	0	10¼	0	0	10¼	0	0	10½
Bottoms,	0	0	10⅝	0	0	11	0	0	11⅛	0	0	10½
Old,	0	0	9	0	0	9	0	0	9	0	0	8¾
Tough Cake, per ton.	93	0	0	92	0	0	92	0	0	92	0	0
Tile,	93	10	0	92	0	0	92	0	0	93	0	0
TIN.												
English blocks, per ton, duty free,	111	0	0	111	0	0	112	0	0	112	0	0
Bars in barrels,	112	0	0	112	0	0	113	0	0	112	0	0
Refined,	116	0	0	116	0	0	117	0	0	116	0	0
Banca, in bond,	115	0	0	115	0	0	116	0	0	115	0	0
Straits, ditto,	114	0	0	113	0	0	113	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	2	6	1	2	6	1	2	6
LEAD.												
English pig,	20	0	0	21	0	0	21	5	0	20	10	0
Sheet,	21	0	0	21	10	0	20	10	0	21	5	0
Spanish pig, in bond,	19	10	0	19	0	0	19	5	0	19	10	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	4	0	0	4	0	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	10	0
Deals, per C, 12 feet hy 3 hy 9 inches.												
Quebec, white spruce.	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	0	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	0	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. hy 2 hy 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	43	0	0	43	0	0	45	0	0	47	0	0
" yellow,	43	0	0	45	0	0	45	0	0	45	0	0
Sperm,	84	0	0	85	0	0	86	0	0	85	0	0
Cod,	39	10	0	41	0	0	41	0	0	41	10	0
South Sea,	38	0	0	38	0	0	39	0	0	38	10	0
Olive, Gallipoli, per tun,	57	10	0	58	0	0	59	0	0	60	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	51	10	0	51	10	0	52	0	0	52	10	0
Rape pale foreign,	52	0	0	52	0	0	52	0	0	53	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt.,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	33	0	0	34	0	0	35	0	0
Jute,	16	0	0	16	10	0	23	0	0	23	15	0
Hemp Rope,	23	0	0	24	0	0	24	0	0	24	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

13th September, 1862.

2521. William Harkes, Lorlock Gralam—Mowing and reaping.
2522. H. J. Lewis, Birmingham—Engines.
2523. Matthew Chadwick, Chapel Field—Folding or plaiting fabrics.
2524. W J. Williams, Arundel Street—Punching metal plates.
2525. T. W. Cowan, Greenwich—Pumps.
2526. A. V. Newton, Chancery Lane—Creasing and raising leather.—A com.
2527. Henry Bennet, Wombridge Iron Works, Salop—Rolling wire rods.
2528. William Palmer, Sutton Street—Lamps.

15th September, 1862.

2529. E. G. Chant, London—Self-binding portfolios.
2530. W. G. Rawbone, Birmingham—Gun barrels.
2531. John Pender, Manchester—Hoops for fastening bales.
2532. Edward Balurforth, Batley—Finishing textile fabrics.
2533. W. L. Tizard, Mark Lane—Vessels, cupolas, and forts.
2534. H. M Radloff, Limehouse—Filtering oils.
2535. James Webster, Birmingham—Nitrogenous compounds.

16th September, 1862.

2536. Edonard Astel, Paris—Uriuary utensils.
2537. John Whines, Pimlico—Dipping match splints.
2538. B. F. Weatherdon, Kingston-upon-Thames, and E. H. C. Monckton, Fineshade Abbey—Motive power engine.
2539. J. G. Bunting, Trafalgar Square—Horse break.
2540. G. L. Lee, Holborn Hill—Shutters for doors and windows.
2541. Stephen Flexen, Farriugdon Street—Ventilating carriages.
2542. William Clark, Chancery Lane—Treatment of peat.—A com.
2543. Richard Moreland, Old Street—Preparing hops.
2544. Robert Lakin, Ardwick—Shielding ships of war.
2545. Harpur Jordan, Southampton—Rotary engines.
2546. C. E. Guye, Switzerland—Fiuishing teeth of wheels.—A com.

17th September, 1862.

2547. Lewis Leigh, Manchester—Stretching fibrous materials.
2548. S. Le Keeler, Percy Street—Veneer cutting machinery.—A com.
2549. Robert Cranston, London—Washing machiue.
2550. James Simpson, Hulme—Coating monlded surfaces.
2551. W. E. Newton, Chancery Lane—Watches or time keepers.—A com.
2552. W. and W. H. Watson, Harrogate—Colouring matters from aniline.
2553. Joseph Douglas, Blackfriars Road—Fire ranges.
2554. George Haseltine, Fleet Street—Manufacture of gas.—A com.
2555. J. H. Johnston, Middlesex and Glasgow—Gas burners.—A com.

18th September, 1862.

2556. Ludwig Mond, Sidney Street—Hyponitric acid
2557. P. H. Whitehead, Rawtenstall—Stand for casks.
2558. Robert Kay, Blue Pits—Printing calico.
2559. W. and J. Todd, Heywood—Collecting waste from spinning machinery.
2560. W. H. Browne, and Henry Armstrong, Middlesex—Gas meters.
2561. G. S. Moore, Sunderland—Ship building.
2562. J. W. Woodford, Walworth—Driving and drawing piles.

19th September, 1862

2563. Thomas Watts, Isle of Wight—Thrashing machines.
2564. George Lowry, Salford—Cleaning fibrous materials.
2565. William Glass, Princes Street—Sulphuret of antimony.
2566. E. de la Bastida, Hart Street—Cover for chimney tops—A com.
2567. William Tytherleigh, High Street—A perpetual heater.
2568. J. and W. Smith, Collyhurst—Measuring and plaiting woven fabrics.
2569. Jean Bouvet, France—Sealing tin boxes.
2570. D. C. Bridge and John Dyson, Halifax—Boilers.
2571. J. B. Giertz, Great St. Helen's—Gas burners.
2572. Frederick Savage, Lynn—Traction engines.
2573. W. M. Cochrane, Kingston-on-Thames—Securing railway fish plates.
2574 John Imray, Bridge Road—Telegraphing.—A com.
2575. R. R. Jackson and John Coupe, Blackburn—Looms.
2576. Charles Chinnock, Regent's Park—Corkscrews.
2577. George Maw, Bruthall Works, Salop—Mosaic inlays.
2578. Edward Feis, Sise Lane—Fastenings for purses.—A com.

20th September, 1862.

2579. P. L. Forrestier, Paris—Photographic albums.
2580. H. R. Fanshawe, Leadenhall Street—Means used in fishing.
2581. Bennet Hotchkiss, New Haven—Atmospheric trip hammers.
2582. Lewis Dixey, Brighton, and George Smith, Angmering—Tinting by lithographic printing, photographic portraits and back grounds.
2583. James Wilson, North Brixton—Incrustation in boilers.
2584. Alexander Prince, Trafalgar Square—Furnaces.—A com.

22d September. 1862.

2585. Charles Mertens, Chelsea—Scutching fibrous materials.
2586. James Sanderson, Clerkenwell—Writing desks.
2587. Harry Holdsworth, Sheffield—Crinoline steel.
2588. James Long, Great Yarmouth—Cleansing streets.
2589. W. M'I. Cranston, King William Street—Reaping and mowing.
2590. Maurice Vogl, Samhrook Court—Fastenings for leggings.

23d September, 1862.

2591. James Mapple, Newman's Place, and Daniel Mapple, Queen's Road—Telegraphic apparatus.
2592. Robert Fairburn, Burley—Fibrous substances.
2593. T. and W. Knowles, and J. and W. Houghton, Gomersal—Looms.
2594. Charles Pontifex, St. Paul's Road—Expressing beer from yeast.
2595. William Dobson, Nottingham—Producing colours on lace.
2596. J. J. N. Micas, France—Railway break.
2597. R. A. Brooman, Fleet Street—Lighting apparatus.—A com.
2598. R. A. Brooman, Fleet Street—Photographic apparatus.—A com.
2599. S. H. Laurent, Paris—Railway brake.
2600. William Wilkinson, Charlotte Street—Knitted elastic fabrics.

24th September, 1862.

2601. John Farran, Bolton-le-Moors—Looms.
2602. William Clark, Chancery Lane—Signalling.—A com.
2603. William Taylor, Chester—Blacking or polish.
2604. R. A. Brooman, Fleet Street—Composition for painting.—A com.
2605. William Maddick, Liverpool—Preparing madder for dyeing.
2606. D. and A. Posener, Rupert Street—India rubber tobacco pouches.
2607. R. R. and A. I. Jackson, Blackburn—Treatment of flax,
2608. R. R. and A. I. Jackson, Blackburn—Cutting fibrous materials.
2609. William Upfill and William Ashbury, Birmingham—Metallic bedsteads.
2610. Thomas Edwards, Blackheath—Preparing fibrous materials.

25th September, 1862.

2611. Robert Alexander, Liverpool—Mariners' compasses.
2612. M. A. F. Mennons, Paris—Chair settees,—A com.
2613. Thomas Kennedy, Kilmarnock—Taps or valves.
2614. Frederick Tolhausen, Paris—Steam cultivator.—A com.
2615. John Raywood, Sheffield—Gas apparatus.
2616. J. R. Breach and E. B. P. Smith, Leeds—Reducing fibres.
2617. James Eardley, Woodville—Tuning pipes.
2618 William Lea, Wolverhampton—Hinges for French casements.
2619. Arthur Potter, Birmingham—Electro-magnetic engines.
2620. Peter Wright, Dudley—Parallel vices.
2621. J. R. C. Taunton, Birmingham—Metallic bedsteads.
2622. E. G. Muntz, Birmingham—Manufacture of axles.
2623. T. R. Harding, Leeds—Carding fibrous material.

26th September, 1862.

2624. William Pettet, Bulstrode Street—Protecting vessels and forts.
2625. J. J. Bates, Birmingham—Sash fastener.
2626. Edwin Dixon, Wolverhamton—Manufacture of welded iron tubes.
2627. C. D. Abel, Southampton Buildings—Purifying lotion for the mouth.—A com.
2628. J. & R. D. Milner, and Frederick Hurd, Wakefield—Preparing fibrous substances.
2629. W. E. Gedge, Wellington Street—Leaden window sashes.—A com.
2630. W. M. Cochrane, Kingston-on-Thames—Railway fish plates.

27th September, 1862.

2631. F. R. Stack, Whetstone—Escalading apparatus.
2632 James Crosby, Audenshaw—Carding engines.
2633. Hiram Hutchinson, Paris—Covering wire with india rubber.—A com.
2634. Michael Henry, Fleet Street—Petroleum and its products, and treating caoutchouc, gutta percha, and their compounds.—A com.

29th September, 1862.

2635. J. C. P. Bauchard, France—Kneading trough.
2636. Hugo Baum, Prussia—Moreens and such like fabrics.
2637. John Brown, Middleton—Carding engines.
2638. Robert Griffiths, Mornington Road—Sheathing iron ships.
2639. Michael Puddefoot, Greenwich—Tilling land.
2640. W. B. Lord, and F. H. Gilbart, Sandgate—Loading fire arms.
2641. W. E. Gedge, Wellington Street—Furnace for casting steel.—A com.
2642. J. E. Walker, King Street—Signalling on railways.
2643. Hermann Hirsch, Bridge Road—Combinations of colours.
2644. Rev. Henry Moule, Dorchester—Heating frames.
2645. Henry Ellis, Bangor—Application of compounds of silica.
2646. Joseph Bucknall, Boston, Lincoln—Horse hoes.
2647. John Addison, Jersey—Securing articles.
2648. R. A. Brooman, Fleet Street—Saddle trees and collars.—A com.
2649. J. H. Johnson, Middlesex and Glasgow—Shells for war purposes.—A com.
2650. W. & W. Carrick—Felting apparatus.

30th September, 1862.

2651. Robert Hoyle, Newchurch—Printing fabrics.
2652. E. J. M. Le Breton, Paris—Propellers.
2653. J. L. Hughes, Worcester—Ornamenting earthenware, glass, &c.
2654. Alexander Prince, Trafalgar Square—Varnish, printing ink, &c —A com.
2655. James Wright, Coptball Court—Rotative travelling crane.—A com.

1st October, 1862.

2656. George Haseltine, Fleet Street—Warming and ventilating.—A com.
2657. P. G. V. Byl, Hyde Park Cardens—Brakes.—A com.
2658. R. W. Greenwood and C. J. Marson, Islington—Using exhaust steam.
2659. Bryan Donkin, Bermondsey—Bearings for shafts, &c.—A com.
2660. Edward Lord, Rawtenstall—Power looms.
2661. W. C. Cambridge, Bristol—Washing clothes and churning.

2d October, 1862.

2662. James Gilchrist, Glasgow—Boring engines.
2663. W. H. Ward, Auburn, U.S.—Signals.
2664. W. C. Wilkins, Long Acre—Gas burners.
2665. Edmund Suckow and Edward Habel, Manchester—Spinning and doubling.
2666. J. H. Johnson, Middlesex and Glasgow—Permanent way of railways.—A com.
2667. G. J. Firmin, Millwall—Salts of potash and lime.

3d October, 1862.

2668. Francis Ensor, West Bromwich, and William Payne, Birmingham—Regulating and indicating apparatus for steam boilers.
2669. John Harrop, Manchester, and James Wadsworth, Salford—Deodorizing refuse, organic, and urinous matters, utilizing coal ashes, &c.
2670. T. J. Robotham, Burslem, and Edward Oswald, Stoke-upon-Trent—Purifying potters' materials.
2671. Richard Broadbent, Leeds—Gas regulators.
2672. William Clark, Chancery Lane—Toy pistols and guns.—A com.
2673. William Clark, Chancery Lane—Candlesticks..—A com.
2674. W. E. Gedge, Wellington Street—Suction and life pump.—A com.
2675. Alexander Dalrymple, Sheffield—Depositing metals by galvanic action
2676. W. E. Gedge, Wellington Street—Marquetry or veneer saw.—A com.
2677. Thomas Greenwood, Leeds—Cutting staves.

4th October, 1862.

2678. J. and W. Lee, Leicester—Traction engines and boilers.
2679. W. H. Muntz, Millbrook—Armour for ships and fortifications.
2680. Andrew Barclay, Kilmarnock—Printing textile materials.
2681. W. E. Gedge, Wellington Street—Spinning pierced or perforated cocoons—A com.
2682. Samuel Amphlet, Birmingham—Ornamenting surfaces of wood.
2683. J. E. Billups, Cardiff—Fixed points for railways.
2684. J. M. Cabirol, Paris—A submarine lamp.
2685. Frederick Parkinson, Wood Street—Ladies' shawls and cloaks.
2686. Francis Watkins, Smethwick—Apparatus for milking cows.
2687. F. F. Blatsfiel, Warwick Court—Diving apparatus.—A com.
2688. William Clark, Chancery Lane—Preserving goods from fire.—A com.
2689. George Whicker and Louis Blaise, St. James's Street—Skates.
2690. Frederick Johnson, Portsmouth—Domestic fire escapes.
2691. William Taylor and Samuel Buckley, Oldham—Preparing fibrous materials.

6th October, 1862.

2692. Robert Page, Great Yarmouth—Stables, kennels, and fish houses.
2693. Thomas Keech, New York, U.S.—Floating batteries.—A com.
2694. John Bradbury, Pendleton, and William Bradbury, Oldham—Carding engines.
2695. Daniel Lowe, Aston—Door bolts and latches.
2696. Samuel Holland, Oldbury—Bricks, drain pipes, &c.
2697. William Clark, Chancery Lane—Articles of clothing —A com.
2698. James Newnam, Crayford—Crystallizing and evaporating.
2699. Thomas Beards, Stowe—Cultivating land.
2700. S. F. Cox, Bristol—Washing and tanning hides.
2701. A. V. Newton, Chancery Lane—Drying grain.—A com.
2702. Charles Chinnock, Brooklyn, New York, U.S.—Axle-boxes.

7th October, 1862.

2703. Joshua Heap, Ashton-under-Lyne—Screw stocks and dies.
2704. Joseph Smith, Egdon—Screw linch-pin.
2705. William Aston, Birmingham—Buttons.
2706. James Oxley, Frome—Separating beer from yeast or harm.
2707. Ferdinand Rahles, Albert Street—Safety envelope.
2708. Alexander Forbes, Aberdeen—Vessels formed of tin plate.
2709. J. D. and A. P. Welch, Gutter Lane—Blocking hats and bonnets.
2710. H. D. P. Cunningham, Gosport—Working guns on board ships.
2711. J. K. Hampshire, Whittington—Washing mineral substances.
2712. John Beale, Maidstone, and M. A. Beale, Barnsbury—Manure.
2713. A. V. Newton, Chancery Lane—Coudensers or coolers.—A com.
2714. C. F. Terry, Sheffield—Propelling vessels.

8th October, 1862.

2715. Daniel Nickols, Manchester—Measuring lace.
2716. W. C. Burden, Leicester—Tuning musical instruments.
2717. Thomas Ratcliffe, Colne—Looms for weaving.
2718. Pierre Clavel, Paris—Violet colours from coal tar oils.
2719. J. R. Harris, Saint Pancras Road—Propelling vessels.
2720. M. A. F. Mennons, Paris—Self-inking hand stamps.—A com.

9th October, 1862.

2721. Hugo Dullens, Little Britain—Fastening for umbrellas, parasols, &c.
2722. Joseph Maurice, Regent Street—Steering vessels.
2723. William Bush, Tower Hill—Cannon and small arms.
2724. C. N. Wilson, Batley Carr—Rag machines.
2725. J. H. Johnson, Middlesex and Glasgow—Polishing stones.—A com.
2726. J. H. Johnson, Middlesex and Glasgow—Paints or pigments.
2727. Robert Hammond, Trafalgar Square—Armour for ships of war.
2728. A. V. Newton, Chancery Lane—Cleaning flax, hemp, &c.—A com.
2729. J. B. Palser, Crown Hotel, Holburn—Paper pulp.
2730. Gustave Simous, Belgium—Plates, rods, axles, tyres, &c.

10th October, 1862.

2731. Louis Hosch, Canon Street—Travelling trunks and portmanteaus.
2732. W. and S. Schofield, Ashton-under-Lyne—Cutting button holes.
2733. R. E. Green and John Cockcroft, Accrington—Amalgamation of materials for printers' blankets, packings for joints, &c.
2734. George Baduley, Hanley, and Henry Greener, Sunderland—Insulators.
2735. J. Lowe, Clarcmont Place, and J. Harris, Newton Abbot—Propellers.
2736. H. A. Marinoni, Paris—Fixing type in the chases.
2737. W. C. Edge, Clerkenwell—Velocipedes.
2738. D. S. Sutherland, Crosby Square—Beams, girders, bridges, and viaducts.
2739. William Weallens, Newcastle-upon-Tyne—Surface condensers.
2740. Thomas Anderson, Glasgow—Ships or vessels.

11th October, 1862.

2741. J. J. Shedlock, Cambridge Street—Gas meters.
2742. E. J. Franklin, Birmingham—A combined spring tape measure needle case, and pin cushion.
2743. Augustine Vennedy, Shoreditch—Composition for covering tips of umbrellas.
2744. R. A. Brooman, Fleet Street—Breech-loading fire-arms.—A com.
2745. William Catchpool, Goswell Road—Fire escapes.
2746. James Durant, Stangate Street—Chimney tops.
2747. Thomas Bouch, Edinburgh—Charging or filling cartridges.
2748. A. V. Newton, Chancery Lane—Manufacture of sugar.—A com.
2749. A. V. Newton, Chancery Lane—Sewing machines.—A com.

13th October. 1862.

2750. Samuel Chatwood, Bolton—Fire and thief proof depositories.
2751. G. and A. Harvey, Glasgow—Boring machinory.
2752. A. F. Gallis, Dean Street—Covering street omnibuses and other vehicles.
2753. George Haseltine, Fleet Street—Jacks and screw nuts.—A com.
2754. Charles M'Carthy, New York, U.S.—Automatic safety valves.
2755. William Loeder, New Broad Street—Projectiles.—A com.
2756. Charles Thomas, Bristol—Artificial stone, silicate of soda and potash.
2757. W. G. Haig, Canonbury Park—A new article of apparel.
2758. Joseph Gumbley, Llantrissent—Break for vehicles.
2759. A. I. Mahon, Dublin—Propellers and paddle floats.
2760. E. B. Wilson, Parliament Street—Iron and steel.

14th October, 1862.

2761. Spencer Smith, High Holborn—Kettles and boilers.
2762. F. G. Grice, West Bromwick—Nuts for screwed bolts.
2763. Edmund Suckow and Edward Habel, Manchester—Spinning and doubling.
2764. Henry Bridson and John Alcock, Bolton-le-Moors—Folding and hooking woven fabrics.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 20th August to 8th September, 1862.

Sept. 19, 4510 George Russum and John Russum, Leeds, Yorkshire—"Corrugated Metalbe Bristle Holder."
,, ,, 4511 Henry Coulter, Liverpool—"A New combined Neck clamp and Lever Gallery."
,, 24, 4512 Samuel Needham, Chelsea—"A Match holder."
Oct. 1, 4513 Richard Sill, jun., Birmingham—"Label, Card, and Plate Affixer."
,, 3, 4514 R. & G. Phelps, Birmingham—"A Locket or other Article of Jewellery."
,, 15, 4515 A. C. Bamlett, Middleton Tyas, near Richmond, Yorks—"Internal Toothed Wheel for Reaping Machines."
,, 18, 4516 G. F. Busbridge, East Malling Mills, Kent—"A Writing Case."

CLOSE OF THE EXHIBITION.

ART. VII.

On Saturday the 1st of November, the Great Exhibition was alleged to be closed, "to re-opeu on Monday as a Bazaar." That which on Saturday was called an Exhibition was on Monday called a Bazaar.

Its career of management has thus been at least consistent throughout. It begau with a job—not yet played out—it ends with a sham. That which was a Bazaar all along—if buying and selling goods on view conld make it oue—though said to be closed, still continues open as an Exhibition—if the assurances of its graud *Claqueurs*, that "it never was so enjoyable and seeable by the select five or six thousand" who still wander about its rather *triste* and cold iuterior, nor so worthy of half-a-crown before; like the temple of Janus, it is shut with a double face—shut and yet not shut.

That which began professing to teach all mankind, of all that is goodly, beautiful, and true, finishes with the anti-climax of its resolution into a Bazaar. The final moral lesson that it gives, is by the statement of something of more than doubtful truth. To endeavour, now that all is before ns, to affirm and swear that it has been, is, and must be held, a great success, however specially pleaded, is simply absurd—to attribute its want of snccess, or such want of it as its puffers are compelled to admit, to the American war, and to the sad and sudden death of the Prince Consort, and to these only, is demonstrably untrue. Its non-success, in every sense, finaucial or otherwise, is logically traceable to a single source—to the gigantic job with which it started—and which, the moment it became concrete in the adaptation of the building, "a double debt to pay"—moulded and fashioned more or less every part of its after career. This was certainly not due to Prince Albert's removal from the scene, mnch less to the American war. The ugliness, unsuitability, aud extravagance of the building sufficed for all that has followed, as any one who can withont bias, counect cause and effect, moral and physical, has long ago seen.

It is neither wise as respects ourselves, uor just to posterity, that good-natnre should canse a veil to be thrown over the past, while the building itself, and all that it was and *is intended* to develop hereafter in the hands of the Science and Art Department of Brompton, the Commissioners of the surplus (or estate) of 1851, or the Society of Arts, Adelphi, stands threateningly before us; rather will it behove the House of Commons, if it wish well to the future of true science, which only wishes to be independent—of genuine art, which will not stoop to be a department of trade—of manufactnres, whose connection with art has been so ill interpreted—and of education, in relation to these, more precious than all, to look well to the anomalous position of irresponsible, and, as it has already proved, ill-exercised power, into which these parties have snceeeded, upon sufferance, in climbing during the past ten years.

If, with a broad glance, we scan the characters of the various classes of prodnctions of this Exhibition, no lesson is so distinctly taught—nothing so forces itself upon any informed and reflecting man, as the absence of *mind and knowledge* evident in nearly all British products, as compared with the correspouding ones of leading foreign nations. This is true, not only in everything where art, taste, imagination, come in as elements; which, more or less, people are ready generally to concede; bnt eqnally so in applied science, in metallurgy, in mechanics, in a thonsand such ways, as we are in the habit of hugging ourselves with the notion, that we are the first in the world.

If this be so, and we are ready, in fit time and place, to prove it so in detail, then no more cogent indictment of incapacity—no more valid argument for change and improvement can be adduced with respect to onr existing institutions for technical education, which may be assumed centred in and represented by the science and art department of the Board of Trade and all with it leagued.

Let us take a few illustratious of the truth of what we have ventured to assert.

Let us recur to the arrangement of the Exhibition itself. What was the most tasteful, indeed the only beautiful part of the whole display? The French court, where the first act of their executive was to board up, to more than thirty feet high, their whole boundary, and shut out all view of the building from the area within, except the inevitable skylight overhead; a pretty significant comment on the building. But bear in mind the interior, with its convergent paths, from the great surrounding aisle of raw products of *La Belle France*, to one centre point of attractiveness. Contrast it with the hideous ironmonger's back shop of the so-called Sheffield court, with the utter confusion of the unmeaning Process court, with the candles and pickles and dolls of the nave.

Let us look now at the contents of a few of the cases or benches. Bear in mind, if memory be not already at fault, the beautiful contrasts of colour and texture that displayed the work of the looms of Lyons, the textures of Arras; and contrast these with the funereal Monmouth Streets of the gallery where our own tasteless textures were hung up in twilight. Then look up to that truly imperial dais of porcelain, of which a well-known English artist, one of the purest in taste, and well acquainted with all foreign art manufacture, wrote to us in such terms as these—"I had another examiuatiou of the Freuch porcelains aud ceramics, and found no bounds to my admiration. In form, in colour, in sense of texture, in adaptation of the ornament to the object, and to the particular surface, they were entirely uncqualled in European manufacture, and in as much as their field is more comprehensive, in Oriental also."

Aud beside these, indeed, how lumpy, rude, inharmonious, uncultivated, seemed even the best of our British porcelains and earthenwares. Great improvement, there is, no doubt, in these—manifest within eleven years—since Albert Smith immortalised John Bull's cartheuware dinner plate; but is the race run in the interval—the goal attained in 1862, satisfactory,—remembering that we did not start from zero in 1851—that Chelsea and Worcester china, and Wedgewood's went before—and that in 1862 all the best examples of British china appear to have been, so far as art is concerned, the production of foreiguers earning their bread amongst us.

Look at the foreign photographs, or the foreign maps, engravings, or woodcuts of their scientific books. Of the first, as contrasted with our own, it will be said—they have the clear sky we have not, but the difference, to our disadvantage, is chiefly remarkable in their superior *artistic treatment* of even the commonest subject. This is also evident even in such dry subjects as geographical maps—which, however, show other merits not reached by us. There were no such maps exhibited as those in the Austrian court, which we are happy to find have been liberally bestowed upon the Royal Geographical Society. There was a papier maché folding screen in the French court that beat anything that Birmingham ever produced in this its own speciality. The scene was a Chiuese garden, not a tea-chest gardeu, but a real scenc of enchanting oriental beauty, with a large crowd of Chinese men, women, and children, all enjoying themselves about a sort of kiosch or summer-house, the figures all natural and well drawn, and full of life and character. The roof of the summer house was of shell, and its nacreous lustre, ruddy with transparent varnish, was made to harmonise with, and reflect the light of the setting sun in a way that might have been honoured in a higher subject; yet here was nought but the old Jennings and Betteridge materials, *and* true art education.

Above it were those wondrous wall panels of printed paper, landscapes that might well have been taken for hand-painting in body colours.

These are a few scattered examples of our subordinate part in matters of taste, applied to manufactures.

Let us turn to some that exhibit, as regards applied science, that the evidences of application of mind here, are not in our favour either.

Take what most Englishmen would call our national machine—the steam engine, and truly it is so, if the genius of one man stamped indelibly upon any machine, can make it a national one to his country. While the characteristic of all the British land-engines exhibited was a monotonous mediocrity, in which all evidence of study, or exact knowledge of *first principles*, were too often wanting; the two engines in

the whole Exhibition that displayed at once the clearest insight into the conditions of theoretic perfection, and the most ingenious and successful advances towards it, were both foreigners, both in reality North American, though one of the two was exhibited by German makers.

It is quite true that against this may be opposed, our colossal marine-engines and superbly turned out locomotives; but great dimensions, exquisite workmanship, due to fine tools and materials, nay, even "the proof of the pudding," as we commonly suppose it, good performance, obtained, as it often is with us, at last, by the costly method of trial and error; are not any disproof of the fact that there is far more application of *mind*, *i.e.*, original inventive and investigative thought, guided and directed by accurate science, shown in the best continental machinery than in much of our own.

Then turning from mechanical to chemical science. Is it needful to do more than name Krupp's cast steel, Deville's aluminium, his platinum fusions, and what the method has led to in the working of that metal? The huge seamless copper and brass tubes in the French court, all tell the same tale, that one of our first scientific British metallurgists, Dr Percy, tells us is the characteristic of all British metal working, *imperfect scientific knowledge*, too often little more than the purblind following of the twilight of experience, *i.e.*, of trial and error.

To point out our own national failings, in any direction, is always an ungracious and unpleasant task. But if we are to reap the very first solid advantage, that any such Exhibition as 1862 is supposed to offer, it must be, not by euphuisms upon the very fine things that we English, did; but by soberly pointing out what we did not do, and, what is worse, were not able to do. And these remarks, humbling as they are, might be extended into many other directions, structural engineering amongst the number, in which, also, we are wont to suppose ourselves quite at the top of the wheel; again, confusing size and costliness, with the beauty of fitness and scientific proportion—but we cannot here go further.

While, as we have said, in regard to applied fine arts, our science and art department never was and never can be anything else than a failure, until wholly remodelled; so as regards applied science, we believe we are surpassed in these manifestations of mind by French, Germans, and Americans, because our own educational machinery is utterly inadequate to the wants demanded by the present time. While in France, Belgium, and Germany, nay, even in Russia, Holland, and North Italy, magnificent apparatus are at work under ministries of public instruction, for providing, in fullest measure of abundance, and of highest quality, the scientific and the artistic educations that are at once convertible into the "bread knowledges" of their skilled industrial classes, almost nothing of the sort exists amongst ourselves. Between the university that educates the future statesman, lawyer, or priest, and which traditionally almost disdains applied sciences, and, at any rate, is above the class who mainly want these; and a few isolated institutions either in the capital or in one or two provincial cities, together with the still fewer private schools, professing (and often no more than professing) a certain technicality of education,—there is, throughout great Britain, a great void, and in this chasm are found flounderiug about, in experience without knowledge, the enormous technical class amongst us, who would hunger and thirst after more exact knowledge, if they but once knew enough to understand its value and power.

As to elementary knowledge—that which every child in the empire should be taught—we don't here make reference to it at all, deplorably behind what is needed, as it unhappily is. That is another affair, and a wider subject, and one not quite within our scope here.

But, improved *technical education* for the working-class, *i.e.*, the wage people, by all means; but far more for those who are to organise and marshall them on, to industrial victory, and to find out fields of new achievement for this great army of labour.

And for this, as it appears to us, we want not the self-satisfied and impotent dilettantism of any society, nor the ambitious jobbery of departments, but, with the light of this Exhibition full upon us still, or upon those of us whose eyes are single in the matter, to have a full and thorough overhaul by Parliament of the whole system and working of our technical and middle class Educational machinery, and the establishment in the issue, probably, of a Ministry of Education, with adequate powers and responsibilities, and Parliamentary enactment, to engraft upon our own social system, what may appear best, and most suitable, of the admirable German and French national system, of technical education.—Ed.

THE PREVENTION OF DECAY IN SHIP AND OTHER TIMBER.

Few subjects have engaged more frequent or more desultory attention than this, and few have afforded a more fertile field for charlatanry; none are more worthy of the best and fullest investigation that the vegetable physiologist, the chemist, and the technologist can devote to it.

That a good deal more accurate and fundamental knowledge, yet remains to be acquired as to the conditions and successive changes that end in decay in timber, and by the removal of one or all of which, its decay may be retarded or prevented, does not admit of doubt by those who are even moderately well read in the scientific literature of the subject. But nothing is more remarkable in reviewing the latter than the way in which all the projects for improved methods of preventing decay march in a beaten track or two, the earliest footmarks upon which are lost in antiquity. Thus, for example, the seasoning against decay of hard and soft woods, by dried and heated air, by wood smoke, and by scorching, is as old, if not much older, than the days when Virgil wrote his first Georgic, and yet some of the very latest practices consist in air-drying stoves, in creasoting, *i.e.*, impregnating with the essential principle of the wood smoke, and in scorching by fire.

The last, which is not only a very ancient mode both of *hardening* and of preventing decay in timber, but one that has been more or less practised almost everywhere in temperate climates, has been brought into renewed notice and prominence by an extremely interesting and by no means unimportant report by M. de Lapparent, a director of the French Dockyards and Inspector of Timber for Naval purposes, addressed by that officer to the French Minister of Marine, and ordered by him to be published.

A translation of the memoir into English has been made by Messrs York & Co., of Royal Exchange Buildings, London, who are interested in a patent which, it appears, has been taken out in this country for M. Lapparent's processes, and which, they state, are extensively adopted, at the present moment, in the dockyards and by the railway companies of France. Of the precise nature of the claims of this patent we are ignorant, but for the general notion of superficially carbonising timber, as a preservative, it is obvious that no patent would be maintainable.

M. Lapparent commences his report with some striking statistics as to the supply and demand of timber, of native and foreign growth, at present in France. He estimates the annual consumption, in round numbers, as follows, viz.:—

	Cubic Feet.
Naval and merchant shipping,	2,800,000
Artillery and engineers,	1,059,000
Railways,	7,063,000
Civil buildings,	56,500,000
Cooperage,	56,500,000
Vine Props,	70,600,000

In the whole of France, the cultivation of the vine involves an *annual* outlay of £4,800,000 for the repair and renewal of the vine props alone, a fact which suggests the amazing importance of the wine trade itself of that country.

All the preceding from *native-grown timber only*, and this takes no account of timber used for mines, internal navigation, carriages of all sorts, hop cultivation, or cabinet work (for the latter much native-grown walnut is employed), and, in fact, M. Burat, the statist of the *Conservatoire des Arts et Metiers*, confidently estimates the total consumption in France as follows:—

For building and manufactures,	353,166,000	cubic feet.
,, firewood,	1,059,498,000	,,
,, charcoal,	529,749,000	,,

Fixing the average price of native timber at thirty francs the cubic mètre (or a little over eightpence per cubic foot,) and knowing from official documents the annual sales under the Imperial Inspector of Forests, and doubling this for the private sales, he is enabled to place in view how utterly inadequate the growth of forest in France is to sustain its existing demand. Another remarkable test which he applies is by showing, that whereas the surface of the forests of France, all in the

hands of the state at the time of the conquest of Gaul by Cæsar, was 40,000 hectares of land, at present these are :—

Royal forests,	1,100,000	hectares.
Forests of other public characters,	1,900,000	,,
Private forests,	3,500,000	,,
Total,	6,500,000	,,

A better method, probably, would have been to have shown, for three centuries back, the gradual advance in the price of timber. However, more than enough is given to ground the pretty obvious conclusion that France is imperatively called upon to husband her stock of timber, and not permit her woods to be exhausted, and the land denuded of its natural clothing, which, wherever it has occurred over large areas, has been attended with serious deterioration of climate, and to which, as is well known, the increase of the most destructive hail storms in various parts of the south of France, have been attributed by no less an authority than Arago and a Commission of the Institute.

M. Lapparent then attacks the more direct object of his memoir, viz., to point out what are the main causes of the rapid decay of timber in shipping, and by proposing palliatives, if not remedies, at once to make the latter, and more especially the ships of the French fleet, more durable, and, as consequences, add to their serviceability, and diminish the consumption of timber for their replacement or repair. He traces up the cause of the rapid decay which he declares to be notorious in the timber-built ships of the French fleet, simply to their being built so fast that there is not time given for the timber to season while standing naked in frame. In the old days of sailing ships, he gives examples of ships that were years upon the stocks, while months only now are permitted.

In fact, it is just our own case with the gunboats of the Crimean war, and with thousands of other vessels for peace and for war. He says—

"I saw the *Austerlitz*, a 90-gun ship, put together in rough timber, at Cherbourg, in April, 1832, and launched in the presence of Monsieur Ducos, then Minister of Marine, in October, 1852. The ship had then been twenty years on the stocks. She had hardly been launched, when it was decided to give her steam power in addition to her sails; she was brought into the repairing dock, where her stern was removed, and replaced by another suitable to her new career. The change took place without dismantling her. The new timbers were immediately covered with broadside planking and ceiling, and the ship left the dock to take her guns on board. Well, that stern, which had hardly seen six years' service, was found to be thoroughly decayed in the beginning of the year 1861, and has since been replaced at Cherbourg, while the rest of her timbers, after more than thirty years, were in the most satisfactory state.

"The stern of the *Charlemagne*, although built under the influence of the climate of Toulon, is in the same plight.

"It is clear, then, that the rapid decay of modern-built ships is traceable to this cause alone—that we cannot leave them sufficiently long on the stocks to become thoroughly seasoned. Such also will be the fate of our magnificent cuirassed frigates, if some efficacious remedy be not speedily applied. The risk is even so much the more to be dreaded for the new ships, as the casing of the upper part of the broadside with the iron plates must have the effect of increasing considerably the inertia of the sides; and the variations of her draught during stormy weather will be much greater, when, by reason of the decay of the ribs, the bolting which fastens the planks to the timbers will no longer have sufficient hold.

"Thus the great expenses entailed by every re-fitting on the one part, the increasing scarcity of bending timber on the other—in short, the immense importance of new and such costly war-ships, of which we shall never have but a limited number, and each one of which will consequently be of immense naval value, ought to induce every one to try and find out a means of remedying *effectually* that inferiority of timber, so serious to the construction of timber-built ships in comparison with iron."

These remarks as to armour ships are full of importance to us who frame them of iron, in some instances, as well as to the French, who have so far given the preference to timber; for let *the backing* of our iron ships become rotten, or even seriously shrunk, as was the case with the *Trusty* battery, and although for a few shots the loose plates will probably resist penetration better than if they were rigidly fastened up to the solid backing, after a few repeated blows they will have recoiled off from their fastening and left the rotten wood backing bare and exposed to fire.

The remedies that M. Lapparent proposes, he classifies under the following heads :—

1st.—The selection and employment of timber, with regard to its natural qualities.

2ndly.—The preservation of store or yard timber, and its preliminary artificial seasoning for building purposes.

3dly.—The precautions to be taken in ship or other building; and under the first of these he makes some observations of much practical value, as to the relative constructive values and durabilities of different growths and sorts of French oak, and of teak, including our own Moulmein teak, of which a large quantity was imported by the French Government for lining the broadside of the armour frigate *Normandie*, and which M. Lapparent declares was all found very soft and inferior. He is induced strongly to recommend the employment largely for the French navy of four new woods from the forests of French Guiana, namely, *Angelique, Coupi, Violet tree*, and *Wacapoa;* and in the following table will be found some of the experimental results upon which he bases this recommendation.

The specimens tried were well and equally seasoned. The space between the points of support was 0·20m. or about 8 inches English, and the apparatus admitted of determining elasticity to nearly the tenth of a millimètre.

	Weight of the Cube Mètre (35½ cubic feet.)	Amount of Pressure.		Elasticity.			Appearance of Fractures.	Co-efficients.		Loss per cent. by 6 months' decay.
		At yielding point.	At point of Fracture.	Under a pressure of 220.10.	Extent of Elasticity.	At Commencement of Fracture.		of Elasticity.	of Fracture.	
	lbs.	lbs.	lbs.	Feet.	Feet.	Feet.			lbs.	
Forest Oak (French)	1644	276	331	0,7874	0,13778	0,21249	short.	62,500	124	30.0
Moulmein Teak (superior)	1435	441	634	0,03937	0,10236	0,14566	in splinters.	125,000	238	15.5
Moulmein " (soft)	1302	386	441	0,07086	0,14960	0,17715	short.	69,500	168	25.0
Guiana Timber. Angèlique	1700	508	607	0,03543	0,11417	0,13778	splinter.	140,000	225	5.0
Guiana Timber. Coupi	2207	500	551	0,04724	0,14173	0,19291	"	104,000	207	0.0
Guiana Timber. Violet-wood	1865	717	883	0,03543	0,13779	0,27559	"	140,000	331	0.0
Guiana Timber. Wacapoa	1858	607	662	0,03937	0,15768	0,19685	"	125,000	248	0.0
Guiana Timber. Balata	2362	828	1048	0,02362	0,13779	0,27559	"	207,500	370	10·0
Guiana Timber. Courbaril	2075	772	938	0,01967	0,14960	0 23632	"	250,000	351	12.5
Guiana Timber. Taoub (yellow)	1910	551	662	0,03543	0,14172	0,35433	"	140,000	248	31.75
Guiana Timber. Saint Martin	2053	717	772	0,03543	0,14172	0,17322	"	140,000	289	14.75
Guiana Timber. Black Cedar	1766	607	662	0,04330	0,13385	0,18716	"	114,000	289	22.5
Beech (injected with sulphate of copper)	1744	331	386	0,05511	0,14172	0,28346	short.	89,000	136,10	30.0
Poplar (injected with sulphate of copper)	86010	22010	276	0,12204	0,12204	0,26622	splinters.	41,500	103,3	10.0

The last column gives the relative losses by artificial decay induced (in the style of the fungus pits of our dockyard experiments) during a period of six months.

The author continues—"It is impossible not to be struck with the astonishing superiority, in every point of view, of the several species of timber from Guiana.

"As chemistry has proved that the substance of ligneous fibre is the same in all vegetables, we must attribute the difference in the durability of timber to the foreign matters with which its fibres are impregnated and enveloped, and which communicate to each species the particular colour, scent, and flavour it possesses. In the white-grained timber, which decays so rapidly, these

matters are almost altogether wanting. Let us return to the Guiana timber.

"The Angèlique especially appears destined to render the greatest service to shipbuilding, for in addition to its qualities of elasticity, strength, and durability, its density does not exceed that of the common oak. On the contrary, the other species are a little heavy, without, however, being excessive in that respect. Their place will be at the bottom of the ship, while the Angélique will be advantageously substituted for teak on the broadside under the iron plates.

"There yet remains the question of the manner in which the timber should be worked, and there is good reason to believe that it will be more economical to cut up the greater part into planks at Guiana. There are often defects in the heart of a great number of these trees, of which there is no outward sign, but which renders many unfit for use."

These results are highly important to us in a national and commercial sense. If French Guiana produces these valuable woods for ship-building there is every reason to suppose that in Berbice, perhaps even in the great Island of Trinidad, the same, or other woods equally valuable, may be found, and thence imported. The suggestion of cutting up on the spot into scantling is a most useful one—it would yield good consequences, not only in the certain quality of the import, but in affording a longer time, by many months—for seasoning, and that, too, in a hot climate before the timber would be turned into use at home. The second part of M. Lapparent's essay is dedicated to pointing out, briefly and simply, what is the value of water seasoning; *i.e.*, seasoning, by the timber being left for a longer or shorter time immersed or floating in water, as is customary in many dockyards. He attributes the removal of sap by this means to the play of *Endosmose* and *Exosmose*, through the superficial pores and cells of the timber, and thence points out, very convincingly—1st, That the value of this seasoning is far from imaginary, or at all doubtful. 2d, That fresh water is greatly more efficacious than sea water for the purpose. 3d, That the water in which the timber is immersed should be constantly renewed in order that the seasoning shall proceed most rapidly and deeply.

To the method of rapid desiccation, rather than seasoning, adopted for timber for building purposes, with us, in London and elsewhere, by exposing it to highly heated air, constantly renewed in hot stoves, he takes some valid objections, and if this method is to be employed at all, he prefers that form of it which is in operation at Toulaville, near Cherbourg, and for which the inventor, M. Guibert, has taken a patent—namely, the blowing through the stove, instead of the hot air, hot wood smoke produced by the slow combustion of saw-dust, waste chips, &c., the particulars of which he gives. He also refers, with some approval, to the method of MM. Lege and Henry Pironnet for injecting timber with sulphate of copper after heat and exposure to vacuum.

We must confess that our own experience and observation of the numerous plans of this last class, that have been from time to time produced —Kyan's with corrosive sublimate, Burnett's with chloride of zinc, others with double salts, supposed, by double decomposition, to produce insoluble matter in the cells of the timber, Boucherie's, and a tribe of others, all for a time vaunted as infallible, and each in succession, after a time, found wanting, induce us to look with the utmost doubt, not to say suspicion, on the value of chemical nostrums, however applied.

As applicable to ship-building, the author's methods consist, in brief, in the following proceedings:—

1st. By disturbing the stagnation of air in the channels or space and room of the timbers.

2ndly. By getting rid of the confined air in contact with the timber.

3rdly. By preparing the surface of timber in such a manner as to prevent the engendering and growth of fungi.

4thly. By impregnating the air in contact with the timber with a substance destructive to the sporules of the fungi.

Into the first and second of these we cannot follow him, and must refer to the original essay for details.

The third comprehends, in fact, M. Lapparent's chief conception, and with the fourth, constitute, we should imagine, the subject of his patent.

He proposes, after the timber is converted and uniformly and perfectly brought to shape, ready to be fitted in place, to char over its entire surfaces to a very small depth (not more than one-third, or even one-fourth of a millimètre) by means of a powerful and concentrated flame, rapidly applied to the whole surface in successive portions. The method he employs for this, consists either of a blowpipe, or a range of blowpipes, supplied with common coal gas and atmospheric air, (the latter passed through a jet to the interior of the gas), or as cheaper, the flame of carbonic oxide, obtained by the combustion of coke, contained in a peculiarly-constructed cupola, of which he gives a figure and description.

Under the fourth head, his proposition is to paint the timbers (after charring), and to pay between the seams, with a mastic or paint composed of:—

Flour of sulphur, ...	200	parts by weight.
Linseed oil, ...	135	„ „
Prepared oxide of manganese, ...	30	„ „

He adduces a good deal of ingenious analogical reasoning, derived principally from the ascertained effects of sulphur upon the peculiar sporadic fungus, that preys upon the grape, and has been called Oidium, allied, no doubt, in many points with the zylophagous fungi,—to prove that this compound must keep the confined air between the surfaces, &c., of ship timbers, in a state so penetrated by sulphurous vapour as to be incapable of supporting these extremely low forms of vegetable life. *Fiat experimentum*, by all means let it be tried. For our own parts, we are not prepossessed in favour of its success.

But as respects the superficial charring, we entertain much more favourable views.

The general fact, that charring on the surface delays decay, has been for ages well known. How it acts, and why it does so, it would take more space than can be here afforded to fully examine. Mainly it acts, we imagine, by simply substituting for the *surface of the wood, where decay must begin, a surface which is not wood*, and in which decay *cannot* commence, and which, though porous, envelopes the wood inside, with a complete *casing*, in which those ferments or fungus sporules, that are everywhere present, cannot germinate, nor yet can gain access to the timber within, which alone is the proper soil in which they can spring into higher organised life, at the expense of the destruction of the organism of the wood.

That the charcoal may play other, and, perhaps, highly important parts is more than probable, and one of its remarkable properties, that of absorbing and condensing in its pores enormous volumes of various gases or vapours, would appear to suggest (what does not seem to have occurred to M. Lapparent) that, possibly, very valuable results might be obtained by exposing his charred timbers so as to absorb such antiseptic gases or vapours as sulphurous acid, creasote, carbolic acid, &c.

The surface charring of timber for ship-building even, is not quite novel, for in the beginning of the last century, the *Royal William*, one of the most remarkable instances of durability that the British navy has supplied, was built wholly, or in part, of timber that had been charred. We are not aware, however, that *this* very effectual and practicable *method* of thoroughly and uniformly charring the surface, and causing the charring to extend to the whole of the opposite surfaces of rents and cracks, has been before employed, and its use appears to us extremely likely to be found to yield unexpectedly important results.

As regards the expense of applying the process, M. Lapparent says—"The results obtained from experiments at the gasometer at Cherbourg, with the aid of a meter, and using a jet of average force, are—

1st.—That the consumption of gas would be about 200 litres per square meter, or 200 gallons per 10 square feet of carbonized surface.

2dly.—That a workman, in an average day's work of 10 hours, would carbonize a surface of 40 square metres, or 440 square feet.

3dly.—That one workman is sufficient for the management of two jets of gas.

It may therefore be admitted that, at full work, the expense would not exceed 15 centimes (1½d) a square mètre, or 10 square feet. Besides, as I have ascertained by experiment, the operation can be facilitated by smearing, in the first instance, the surface of the timber with a little tar, and by so doing other advantages are gained. In fact, it is obvious, that when systematised upon a great scale, the cost of the process would be extremely small, and the rapidity of its execution as great as might be desired."

It might even be matter for experiment, whether this "actual cautery" might not be very advantageously, applied locally, round every place in a ship being repaired, where rot or fungus had shown themselves.—Ed.

SUGAR MACHINERY IN THE GREAT EXHIBITION.

Although something has been said in the *Practical Mechanic's Journal Record* upon the sugar machinery of British manufacture lately exhibited in the great building at South Kensington, the importance of the manufacture, in a commercial point of view, justifies a return to the subject in these pages, the more especially as we can here enter more into details which some of our readers in our sugar-producing colonies may like to have.

The largest sugar mill in the Exhibition was one contributed by Messrs Mirrlees & Tait, of Glasgow. The vertical cylinder condensing engine, which works expansively, was of 60 horse-power; the crushing rollers were 7 feet long, and had a diameter of 2 feet 6 inches. The pump for lifting the juice, as it is expressed, was worked by a crank attached to one of the rollers. The total weight of this ponderous machinery is about 143 tons, and the cost, without the engine boiler, is about 3000 guineas.

Messrs Fawcett, Preston & Co., of Liverpool, sent a well made mill, with rollers 7 feet long, and a diameter of 42 inches, driven by an engine of 30 horse-power.

As already stated in the *Practical Mechanic's Journal Record*, the chief point of novelty as regards the mill is that the head stocks are

cast in one piece as a security against breakage. To obviate the objection that in mills thus made there may be a difficulty in getting out the rollers, an improvement has been made in the fitting of the roller-wheels by which they can be easily detached. As to the engine, great simplicity of parts has been aimed at, as of permanent importance in those countries where sugar mills are employed, in order that skilled labour may be dispensed with as much as possible, in case the machinery should be accidentally damaged. Hence we have in this engine a belted cylinder and simple short slide, a pair of guides in place of a parallel motion, and a wrought iron connecting rod.

Messrs W. & A. M'Onie, of Glasgow, a firm long honourably known for their sugar machinery, exhibited two mills. The larger was driven by a high pressure expansive steam engine of beam form, having a six columned entablature supporting the framing. The steam cylinder had a diameter of 21 inches with a 3½ feet stroke, and was fitted with the usual short slide valve and a separate expansion valve arranged to cut off the steam at any part of the stroke. The fly wheel had a diameter of 18 feet; the main shaft and other moving parts were all of forged iron. This engine was regulated to run at 35 strokes per minute, and, with high pressure steam, was capable of being worked up to from 60 to 70 indicated horse-power. The mill was of the usual three rollered form, the rollers being 5½ feet long, with a diameter of 28 inches. The mill bed formed the receiver for the cane juice, and the side framings for carrying the rollers were so constructed that any of the rollers could be removed if required without dismantling the framework. The connection of the engine power to drive the cane mill was carried through a set of double gear spur wheels, which, with their shafts and bearing standards, were severally arranged inside, and fixed to a strong bed casting. The speed of the steam engine and gearing was arranged so that the surface of the periphery of the mill rollers moved about 19 feet per minute. This mill was of the size of those frequently sent out by this firm to sugar estates in the tropics. It was calculated to express juice sufficient for from ten to twelve tons of sugar daily. The weight of the whole machinery was stated to be (without boiler) 75 tons, and the price was about £2000. We may mention that this firm has manufactured some of the largest sugar mills sent out of the country. They have made mills with rollers of three feet diameter, driven by engines of 200 horse-power, and one set of their machinery weighed 200 tons. The smaller sugar cane mill exhibited by Messrs M'Onie, was one intended to be worked by bullocks or mules. The rollers were two feet long by 16 in. diameter. In general arrangement this mill was of the same character as the large mill, but it was fitted with the parts required for the attachment of the driving cattle. The price of this piece of machinery was about £150. This class of mill is still employed in sugar producing countries, especially in hilly districts where the nature of the country opposes obstacles to the transport of heavy machinery and fuel.

Messrs J. C. Wilson & Co., of Cannon Street, London, sent a small mill complete, with engine and boiler, which they guaranteed to express juice sufficient to make one ton of sugar per diem. This machinery is illustrated in the accompanying cuts. The engine was of 8 horse power; the rollers are two feet in length, and have a diameter of 18 inches. The total weight was between 8 and 9 tons. It is put forward as a recommendation of this mill, that it is supported on a substantial iron foundation plate, to which the whole of the machinery, including the boiler, is bolted. This bed-plate forms of itself a sufficient foundation when placed upon a level and solid piece of ground, brickwork setting not being required. The steam engine was of horizontal construction; and the mill had three horizontal rollers fitted with strong side frames, so arranged that the lower rollers could be withdrawn without disturbing the top one. The boiler was tubular, and covered with wood lagging, like a locomotive, to prevent escape of heat. There was an iron chimney, and the usual boiler mountings, with a dial steam gauge, a locked safety valve, &c. Strength, freedom from risk of breakage, steadiness of motion, portability and facility of erection, were claimed by the exhibitors, for this mill, the cost of which, with engine and boiler complete, was put down at £400. As the process of erecting the mill is simple, an ordinary mechanic exercising a little care, might be entrusted with it; and owing to the nature of the arrangement the whole of the parts might be put together in the workshop, before exportation, and a satisfactory trial obtained. A mill of the size already described, and all the requisite apparatus for making sugar, including Wetzel's pan, could be had for about £950. Mills of the same construction, from 4 to 70 horse-power are supplied by Messrs Wilson, and their charge for one with an engine of 35 horse-power, driving rollers 4 feet long by 24 inches diameter, the whole weighing nearly 40 tons, would be about £1200, independent of the sugar making apparatus. Nothing in mechanical detail of arrangement could well have been much more objectionable than this Sugar Mill and Engine, as has been pointed out in the *Record*.

Messrs Napier & Son, of Lambeth, exhibited a centrifugal machine for separating molasses from crystals in the manufacture of sugar, which was said to be continuously self-feeding and self-discharging. A hundred weight of dry sugar per minute was promised by the use of this machine, but we could obtain no explanation as to the construction, mode of working, or cost. From Messrs Maulove, Alliott & Co., of

Fig. 1.

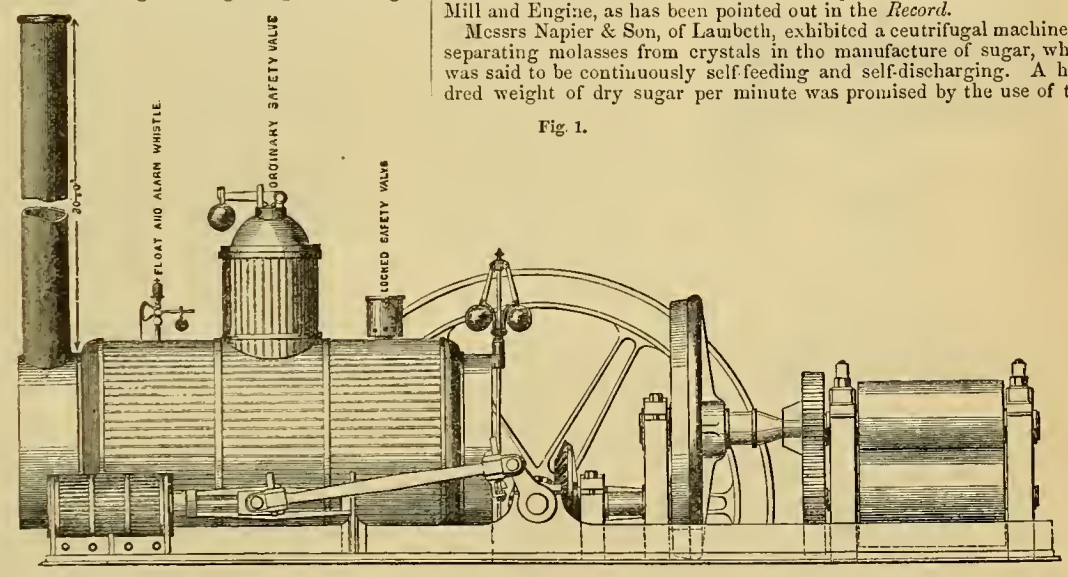
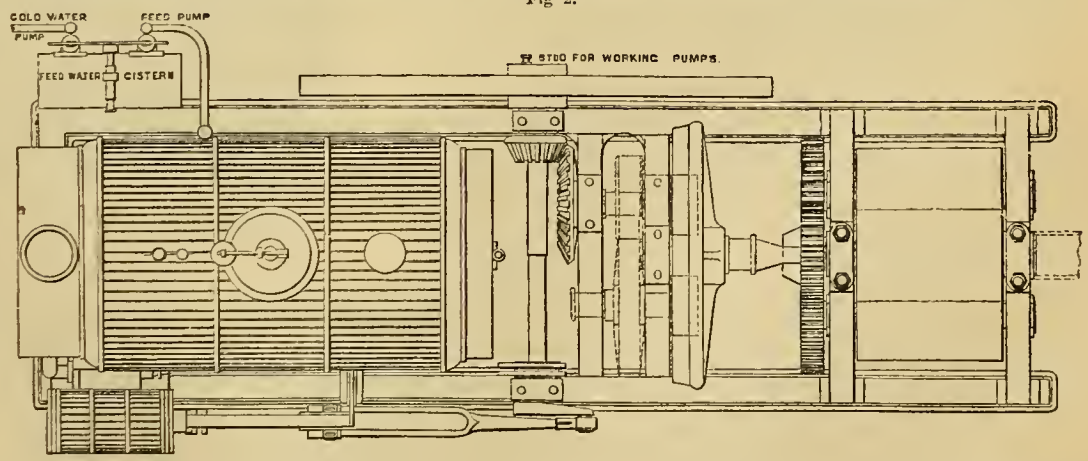


Fig 2.

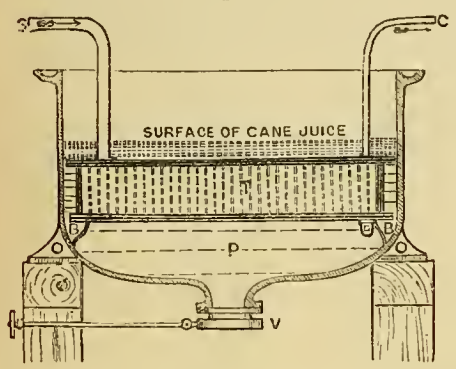


Nottingham, we had a sample of their well-known and effective centrifugal apparatus for the making of sugar, by the rapid revolution of a wire gauze cylinder. Each pair of cylinders could be made to be driven by a pair of engines of 3 or 4 horse power, and the whole then costs £205. They could also be driven by any engine the sugar manufacturer may have on his establishment, and in that case the necessary gear, and the pair of centrifugals, cost £154.

Amongst the apparatus for the concentration of cane juice, there was an example of the bour pan, manufactured by Messrs Cook & Co., of Glasgow, the owners of the patent. This effective apparatus consists of a series of large copper lenticular dises, which are hollow, and connected with each other. These are kept slowly revolving, with their lower parts passing through a long basin containing the hot juice to be concentrated. Steam is passed through the discs with a view to heat them and assist the evaporation. The cost of the apparatus with ten discs, is about £175.

One of Aspinall's open evaporating pans, fig. 3, was exhibited by Messrs Fawcett, Preston & Co., which is said to be worked to the best advantage when supplied with liquor from the open train, at from 26° to 30° Beaume. The advantage claimed for this pan is its immense rapidity of evaporation, due to the constant passage through the syrup of streams of dry hot air, carrying off the water. Its arrangement will be seen from the wood-cut.

Fig. 3.



P, represents Aspinall's Pan, filled with Syrup to about an inch or two above T, the Tube Box or Steam Chest which rests upon Brackets B, and is fitted with vertical tubes, open top and bottom, so that the syrup has free passage through them. The steam which surrounds the tubes being admitted through S, the Steam Pipe. C, is the pipe through which the water of condensation escapes, thus arranged to avoid joints in the Pan, and to make it easy to cleanse, for by lifting out the Tube Box it leaves only the plain Pan to wash out V, the Discharge Valve, worked by a hand-wheel and screw, O, outside the brackets on which the Pan rests, so that a few pieces of timber are all that are required for its support.

Amongst the models of machinery, &c., connected with sugar manufacture, are the rollers of a cane crushing mill sent by Messrs Bellhouse, of Manchester; and Chantrell s furnace for revivifying animal charcoal.

In the Eastern Annexé there was deposited an interesting collection of sugars, from every sugar produeing country in the world, including Spiam, Monrovia in the republic of Libcria, and Natal. Alongside the best quality from every country, was placed the worst. The animal carbon employed in the refinery process was exhibited, as well as the syrup from which our white lump sugar is obtained, and the treacle or molasses, representing the uncrystallisable residue. This collection was contributed by Messrs Martineau & Sons. Close by, was a drawing representing a sugar refinery in section, with the different processes in the treatment of sugar, from its reception at the works in the shape of the coarsest brown to its conversiou into the whitest loaf sugar.

WHITWORTH AND ARMSTRONG FIELD GUNS.

Some very interesting trials of rifled field guns took place at Fort Twiss, near Shorncliffe, last week, in the presence of general Bloomfield, Inspector-Geueral of Artillery, and a large Staff of officers. For the first time an open comparisou was made between the Whitworth and Armstrong field guns. Four of the former, and two of the latter were fired side by side. The Whitworths formed part of a battery of brass muzzle-loading 12-pounders—the first rifled on Mr Whitworth's system that have been placed in actual service. The Armstrougs were breech-loading iron 12-pounders. The brass, muzzle loading gun, which is never out of order, never disabled in the breech, and little liable to injury from accident or weather, has much to recommeud it. France has always preferred these guns; they are worked as easily as the old smooth-bores, while, with Mr Whitworth's system of rifling, they are, (as appears from the late Shorneliffe trials) superior in percision and rapidity of fire to the breech-loading Armstrougs of the service. The trials at Fort Twiss began by firing at a floating target, distant 500 yards; as the shot fell in the sea, no very accurate comparison could be made as to the respective hits; but both at the 500 yards' range and at the 1,200 yards' range, at which the guns were afterwards fired, the Whitworth was the first to shoot away the flag aimed at. On the whole, the shooting of the Whitworth at both ranges was evidently closer than that of its rival. Both guns were tried with shell; the Armstrongs fired the compound percussion shells, many of which burst high in air, and of course ineffectively. The Whitworths fired a new kind of shrapnel, under the superintendence of Colonel Boxer, who has, by permission of the War-office, rendered Mr Whitworth most valuable assistance in perfeeting this new projectile. It is ignited in front, like the old shell, by means of the simple Boxer time-fuse, and all the complication of percussion apparatus is dispensed with; at the required moment the bursting charge blows off the front of the shell, scattering from 40 to 50 bullets of lead and segments of iron, all of a size large enough to be effective. The iron case of this shrapnel, when fired at long ranges, is not broken up, but, weighing 7lb., or 8lb., it acts as a solid shot, and remains effective, after it has delivered its contents in a diverging shower. So that, while the bullets and segments would take effect upon a group of artillerymen, the heavy hollow case would smash a gun carriage, or otherwise disable a gun. If required for short ranges the irou can be burst into fragments by increasing the bursting charge. The practice with these terribly efficient projectiles was, on the whole, excellent; very few burst short. Perhaps the most interesting part of the trials was a comparison made between the Whitworth and Armstrong guns with regard to rapidity of fire, in which the advantage, was on the side of the Whitworth. Twenty rounds were fired from each gun as rapidly as they could be served. The first gun that completed its 20 rounds was a Whitworth, which finished in 13 minutes; the second, an Armstrong, which finished in 15½ minutes, the Whitworth proving the victor by 2½ minutes. This result was owing to the simplicity of the method ofloading and serving the muzzle-loading Whitworth —the drill in fact, being that of the old smooth-bore. All the guns were further tried by firing from each a hundred consecutive rounds. The Armstrongs were fired with lubricating wads, and were washed out, and changed their breech pieces as often as they became disabled by being overheated. The Whitworths all completed their 100 rounds without being washed out at all, and without using any lubricating wads. The loading of the guns was as easy at the last round as at the first. This practical proof of the efficiency of the brass muzzle-loading guns will be very gratifying to those who prefer their simplicity to the complication of the breech-loader. In point of economy, the use of the brass guns is advantageous, both as regards first cost of manufacture and non-liability to injury from exposure to weather. All the old material now existing could be employed, and the cost of recasting an old 9-pounder and of completing it as a rifle muzzle-loading Whitworth field-guu would only be about £10 per gun.—*Army and Navy Gazette.*

The preceding notice called forth from Sir William Armstrong, in the *Times* of the 6th Nov., 1862, a somewhat warm letter, in which, though not much new matter on either part is brought forward, nor, indeed much to damage Mr Whitworth's inventions, Sir William justly complains of the obvious bias of the accounut given of these trials, and of their having been conducted in his absence.

Mr Whitworth has rejoined by a still longer letter in the *Times*, of the 10th Nov., 1862—the most pertinent part contained in which is the admission that he has in reality thrown some obstacle in Sir William Armstroug's way in his experimenting with flat-ended shot or shells. We should be greatly surprised if *any* patent could hold water a moment, for the use of flat-ended rifled projectiles, for, to our own knowledge they were proposed, made, and fired from rifled guns, and those, too, guns of *wrought* iron, made from designs by Captain Pottinger, of H.E.I.C. service, for the coast guard service of Ireland, more than thirty years ago The object being to *punch holes* through, and sink smugglers' small vessels.

The real relative merits of the Armstrong and of the Whitworth systems, if we may dignify their respective guns and shot with such a word, will never turn upon questions of five or of six miles, or of any other enormous useless range, nor upon which can fire 20 rounds fastest, nor upon whether either or both can punch clean little round holes through armour-plates, with flat or round-ended shot, and at distances, more or less.—Ed.

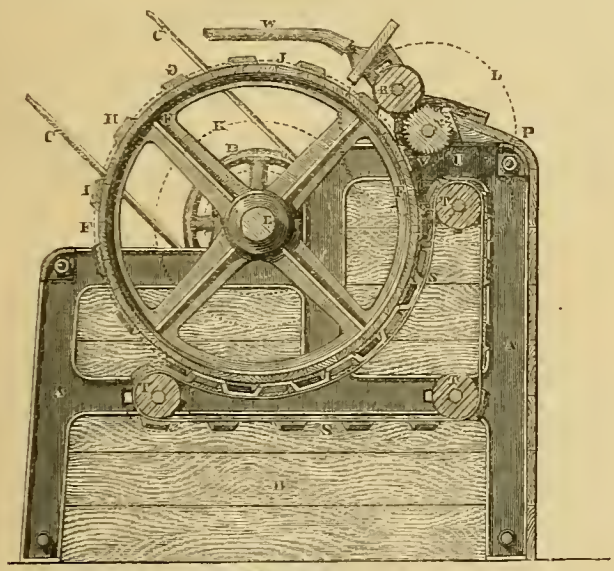
FLAX AND FIBRE DRESSING MACHINE.

The machine shown in the accompanying engravings has been introduced into this country from America, by Mr G. Sandford, and attracted considerable attention at the International Exhibition. The object of the invention is one of high importance, namely, the production of fibres suitable for textile manufactures in a much more rapid and efficient manner than has hitherto been accomplished. Under any circumstances, a machine capable of effecting an important saving of time and labour in preparing fibrous materials, would be entitled to considerable attention; but in the present juncture of affairs, any combination of mechanism that will facilitate the preparatory processes of obtaining fibre suitable for the spinner, becomes doubly interesting. It is stated that by means of this machine the woody matter or "boon"

of the stalks of fibre yielding plants may be quickly broken up, and the fibre obtained in a clear state. So also with the leaves of fibre yielding plants, that the chlorophyl or vegetable matter in which the fibre is imbedded, may be quickly separated and the fibre obtained clean, and what is of great importance, without any diminution of its strength. If this is proved to be the case, a much larger quantity of flax may be prepared by the growers for the market than heretofore, and so as to yield a larger profit on account of this saving of time and labour. In addition to this source of supply, there are the fibrous plants which have been used to a limited extent in manufacture, and also the numerous varieties indigenous to the East and tropical climates, which may be made available to supply, to a considerable extent, the scarcity of cotton, provided that a quick and easy mode of preparation could be carried out in convenient proximity to the place of growth. The machine we have illustrated is stated to be particularly suitable for preparing New Zealand flax, China grass, the leaves of the plantain, aloe, pine apple, and other vegetable products of a similar kind.

Fig. 1 of the accompanying engravings is a sectional elevation of the Fibre Preparing Machine, and fig. 2 is a plan of the same. The fram-

Fig. 1.



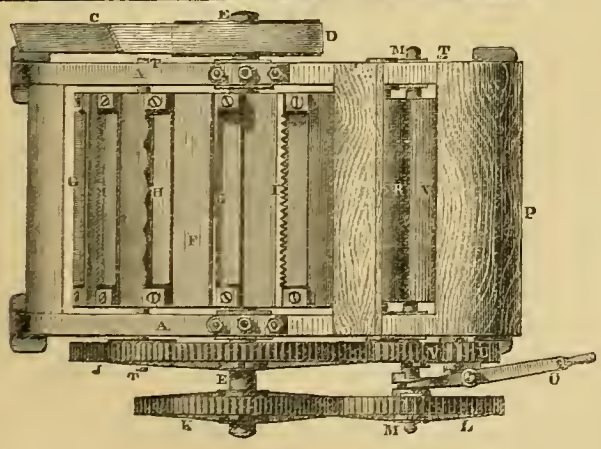


Fig. 2.

ing, A, is formed of cast iron end standards connected by transverse tie rods, the whole being enclosed by the wood casing, B. An endless belt, C, gives motion to a pulley, D, which is carried on the end of the horizontal shaft, E, that extends across the machine. On this shaft is fitted the main cylinder or drum, F, the periphery of which is covered with vulcanized india rubber; over this material are secured three series of bars, G, H, and I; these are arranged parallel with each other. The bars, G, are made with serrated edges, the next bars, H, are made with straight edges, and the bars, I, have waved or undulating edges. On the outer end of the shaft, E, are fitted two spur wheels, J and K, which alternately give motion to the feed rollers. The outer wheel, K, gives motion to the wheel, L, running loosely on the shaft, M, of the feed roller, N. The wheel, L, is brought into gear with the shaft, M, when required, by means of the coupling and hand-lever, O. In treating flax, the stalks of the plants to be operated upon are placed on the feeding board, P, and are fed in between the rollers, N and R, one of which is of fluted metal, and the other is covered with india rubber; the straw passes between these rollers at the rate of 160 feet per minute. It then comes in contact with the drum, F, and the endless belt or apron, S, which are driven at a speed of 800 feet per minute. The belt, S, is carried round the rollers, T, and to it are attached a series of bars like those on drum, F. As the straw passes down between the drum and the belt, the bars with the plain edges serve to scrape the straw, whilst those with the serrated edges break up the woody part into short particles, and, at the same time, keep the fibres straight; most of the woody matter falls into the spaces between the bars, the belt being open to admit of the waste falling through. In this way, both sides of the straw are equally operated upon, the most efficient action being obtained by setting the bars on the belt so as to strike the straw on one side about an eighth of an inch in advance of the contiguous bar on the drum. The remaining *shoores* are scraped off and carried out of the fibre at the end of machine, through channels which the teeth keep constantly open. The construction of the machine is such that the flax-straw upon being fed in is first bent one way, and then the other. The first effect of this bending motion is to relieve the fibre from the *boon* longitudinally, the next effect is to break it, but not until after the bars have first loosened it. This action avoids the possibility of injuring the fibre by the teeth and scrapers in removing the *boon* or *shoove*. In working this machine one person places the flax-straw in a clamp about two and a half feet long, and an inch wide, by half an inch thick; the inner surface is lined with rubber so as to yield to the unevenness of the straw as it is laid in. The clamp is jointed at one end like a "newspaper holder," and is very similar in appearance. Each clamp filled with the straw is laid upon a table near the machine, and is then taken by another, who presents it to the feed rollers, holding one end of the clamp until the rollers have drawn the straw in. After the straw has been drawn a little more than half its length, the operator shifts the lever, O, which brings the wheel, U, into gear, with the intermediate wheel, V, that is driven from the spur-wheel, J. This reverses the motion of the feed rollers, which are so arranged that they feed the flax *out* five times as fast as it was fed *in*. The operator then presents the other end of the straw held in the clamp, which is fed in as before. The product, after undergoing this operation, is in a fit state to spin into all goods of a coarse character, such as twine and towelling. For fine goods, as in the case with flax fibre dressed by all other modes, it has to pass through a subsequent hackling process, but with this remarkable difference: The fibres cleaned by this machine being all unbroken and uninjured, and each fibre being perfectly parallel with every other fibre, and being entirely free from *boon*, the hackling process is attended with very little waste.

The inventors claim on behalf of this machine that the yield of flax fibre by its use, in proportion to the weight of flax straw dressed, *exceeds by at least one fourth*, that obtained by any other machine or process; that the fibre dressed by this machine is much more valuable than that dressed in any other way; that it is so simple in its construction and operation, that the liability to derangement is very slight; that it does not require in its use any peculiar skill. It can be attended to by boys or girls, and does not involve any risk to the hands or arms of the operatives, while the ordinary scutching machine requires the use of skilled labour, and as experience has proved, is always attended with risk to the operatives; that it can be driven by horse power, and as it can be worked by ordinary farm labour, it enables the farmer to dress and prepare for market, at little expense, the flax raised by himself; that it is small, occupying only a few cubic feet, and weighing not more than 450 pounds.

The flax machine is said to be capable of producing from 120 lbs. to 130 lbs. of clean fibre per day. It leaves the fibre perfectly clean, unbroken, evenly laid, and of full length, with good ends. The flax may be either retted or unretted, and the straw requires no previous breaking. From retted flax the yield is from 20 to 25 per cent. of the weight.

The fibre machine promises to be a very useful piece of apparatus in warm countries where there is great abundance of fibre-bearing plants, the fibre of which is now utterly lost from the want of an effective machine of this nature. From green plants perfectly white fibres are produced, and it is capable of treating upwards of 1500 leaves of the agave or American aloe per diem, whilst only some 40 or 50 can be treated by a labourer in the same space of time. In addition to the plants already mentioned, the leaves of the pine-apple, and the stems of the so-called China grass, may be treated by it. Steam power equal to one horse is quite sufficient for it, and the attendants may be two boys.

This machine differs but little from that previously described; the transverse toothed and scraping bars of the revolving drum are, in this case, set on a bed of india rubber. Moreover, a pipe, W,

brings a supply of water, which is poured from above upon the vegetable matter undergoing treatment, by which contrivance the non-fibrous matter is washed away as it is separated from the fibres by the action of the machine. The bars of the drum, and those of the band, should be adapted, as to the relative proportion of the toothed and scraping bars, to the nature of the work, and as they are attached by nuts aod screws, some can be separated, and others put in their places. An ordinary-sized machine will have feeding bars 16 inches long, and a drum of 30 inches diameter.

MR NASMYTH'S IMPROVED FORM OF LINK MOTION.*

In many important applications of the Steam Engine, it is essential that we should possess the means of reversing at pleasure the direction of the revolution of the crank sbaft.

Prominent instances of the desirahleness of this capability are presented in the case of the locomotive and in the marine engine, as also in the case of "winding engines," as employed in colliery and other mining purposes.

Many contrivances have been resorted to for the attainment of the object in question, all of which, however, have been characterised by considerable complexity, and consequent liability to derangement, unfaithfulness of action, as well as rapid wear and tear.

It was not until the invention and introduction of the justly celebrated "link motion," that the problem of how to reverse the motion of a steam engine received its *perfect* solution, at the hands of a mechanic in the service of Robert Stephenson & Co., of Newcastle-upon-Tyne, who in the invention of the link motion, added one of the most beautiful and perfect details to the steam engine, and has thereby conferred a vast benefit on mankind. Not only does the "link motion" solve the problem of "how to reverse the action of the steam engine;" but also by its means we obtain at the same time a variable expansive valve motion, combined with a means of arresting in the most gentle, yet effective manner, the motion of the steam engine, and in these respects combines in one beautifully simple whole, the properties of reversing gear, expansive valve gear, and throttle valve, all in one.

So perfect in all these repects is the action of the link motion, that the form first given to it by its inventors has been universally accepted, and became traditionary, in so far at all events as regards the loop or link form of its main and distinguishing feature is concerned. In the application of this beautiful invention to marine engines of the largest class, some disadvantages latent in the *loop* or link power begin to manifest themselves; the chief of which is the constructive difficulty of taking up the slack naturally due to the wear and tear of the swivel block, working inside the loop of the link, and the consequent unpleasant knocking action and increased wear which naturally accompanies any such undue slackness in the moving parts. Besides which, in order to give the requisite amount of rigidity to the large size of link employed in engines of the most powerful class, an amount of material has to be introduced which is in every respect desirable to avoid.

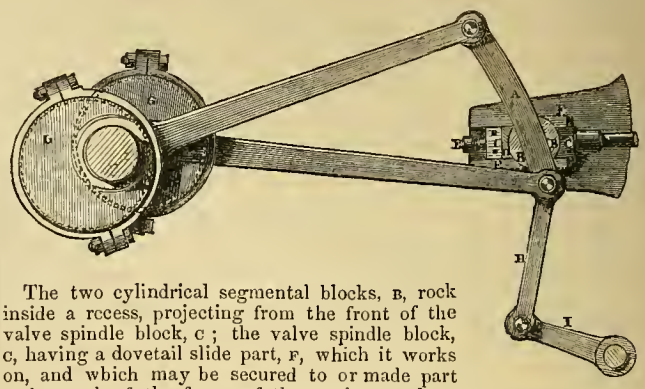
It was with the view to remove these objections, as well as to simplify and economise the cost of construction of such link motions, that Mr Nasmyth contrived in 1852 what he terms his "*solid bar*" form of the link motiou, and which he in the same year first introduced into actual machinery in a colliery winding engine which he made for a firm in South Yorkshire.

The perfect action in practice which was found to attend this simple "solid bar" forin of the link motion, led his friend Mr Edward Humphrys to introduce this solid bar link motion into his marine engines, in doing which, Mr Humphrys has displayed his usual high skill and judgment, in the admirable manner in which he has adapted Mr Nasmyth's invention, as may be seen in those magnificent marine engines of 400 horse power, which Mr Humphry's firm has sent to the great Exhibition of 1862.

As it is presumed that this subject can only iuterest those practically conversant with the details of steam engines, it will not be requisite to enter into any detailed description of "the link motion," as such, but simply to point out the nature of the modifications of form which specially characterise Mr Nasmyth's arrangement of it. The main feature of which consists in the substitution of a solid bar, A, in the accompanying engravings, in place of the usual link or loop form of the part in question.

This solid bar, A, is coupled with the sliding block, C, to which the valve rod is attached, hy means of two cylindrical segmental rockiug blocks, B, hetween which the bar, A, slides, where one or other of the eccentrics is caused to couvey its chief action to the valve.

The substitution of the simple solid bar, *a*, for the opeu link or loop hitherto employed, is not only more rigid and exact in its action, as well as economical in its construction aud material, but by means of the setting up pad piece, *d*, and its set screw, E, all "slack" due to wear and tear can be removed, and the most perfect yet easy fit secured.



The two cylindrical segmental blocks, B, rock inside a recess, projecting from the front of the valve spindle block, C; the valve spindle block, C, having a dovetail slide part, F, which it works on, and which may be secured to or made part and parcel of the frame of the engine, and so secure most perfect exact action to the motion of the valve block, C, and its attached valve rod.

The lever, I, and connecting bar, H, are the means whereby the one or other eccentric, is made to convey its chief action to the valve in the usual manner.

A cover plate attached to the slide block, C, by four small bolts, the holes for which are indicated, keeps the slide or link bar, A, and the rocking segments, B, in their respective positions, and renders them easily accessible when need be.

STEAM CRANE OR DERRICK.

By Andrew Barclay, *Engineer, Kilmarnock, Patentee.*

Illustrated by Plate 294.

The plate which accompanies the present number of our *Journal* represents a new form of crane or hoisting apparatus recently introduced by Mr Andrew Barclay, to whose inventions we have frequently had occasion to direct the attention of our readers. One object the patentee has had in view is to obviate the inconvenience which attends the ordinary crane; when the load has been raised to the required height, a serious loss of time occurs whilst the crane is turned slowly upon its axis, in order to carry the load into the warehouse, or deposit it near to the spot required. Mr Barclay has, in his new form of crane, managed to overcome this difficulty in a very satisfactory manuer, and obtain a rapid motion of the load in a horizontal direction, without requiring to turn the crane upon its axis. The advantage of this improvement, either in loading or unloading, will be at once evident, when it is stated that the moment the load is raised so as to have a clear way in the horizontal plane, it is moved with great rapidity in the direction required, the jib sustaiuing the load being arranged so that it can he moved to and fro with the utmost facility.

Fig. 1 of plate 294, represents an elevation or side view of one arrangement of the cranes or apparatus for lifting, lowering, or moving heavy bodies. In this view, a portion of the lower part of the main pillar is broken away, to show more clearly the arrangement of the working parts. Fig. 2 is a corresponding end elevation of the crane, with one of the diverging back stays broken away.

The crane is supported on a cast-iron socket or base plate, A, which is holted down in the ordinary way to the masonry beneath, or to the platform on which the crane is erected. The central part of the base plate forms a tubular socket to receive the pivot which forms the lower extremity of the crane. If the crane is arranged to be actuated by steam-power, as delineated, the pivot is made tubular, and works steam-tight in the socket, so as to serve for the admission passage of the steam to the cylinders above. The lower part of the main pillar of the crane from which the pivot projects, forms a cast-iron hox, B, from the ends of which spring the side pieces forming the crane post or main pillar, C. The framing of the pillar is bolted together by transverse tie bars, and terminates at the upper part in the cap, D. The pillar is steadied and partly supported by the back stays, E, which are bolted down to the platform or wharf, the eyes on the upper parts of the stays passing over the pivot in the cap, D, in the usual way. To the lower part of the pillar, C, is holted the bearing plate of the jointed socket-piece, F; this socket-piece is made duplex to receive the side pieces, which form the jib, G. The parts of the jib are connected in manner similar to the pillar, C, or in any other convenient way. The outer ends of the ribs of the jib, G, terminate in iron caps to admit of the secondary jib, H, being jointed thereto, and of its moving freely about the point of support. This jib is formed of a spar of timber or other suitable material; the

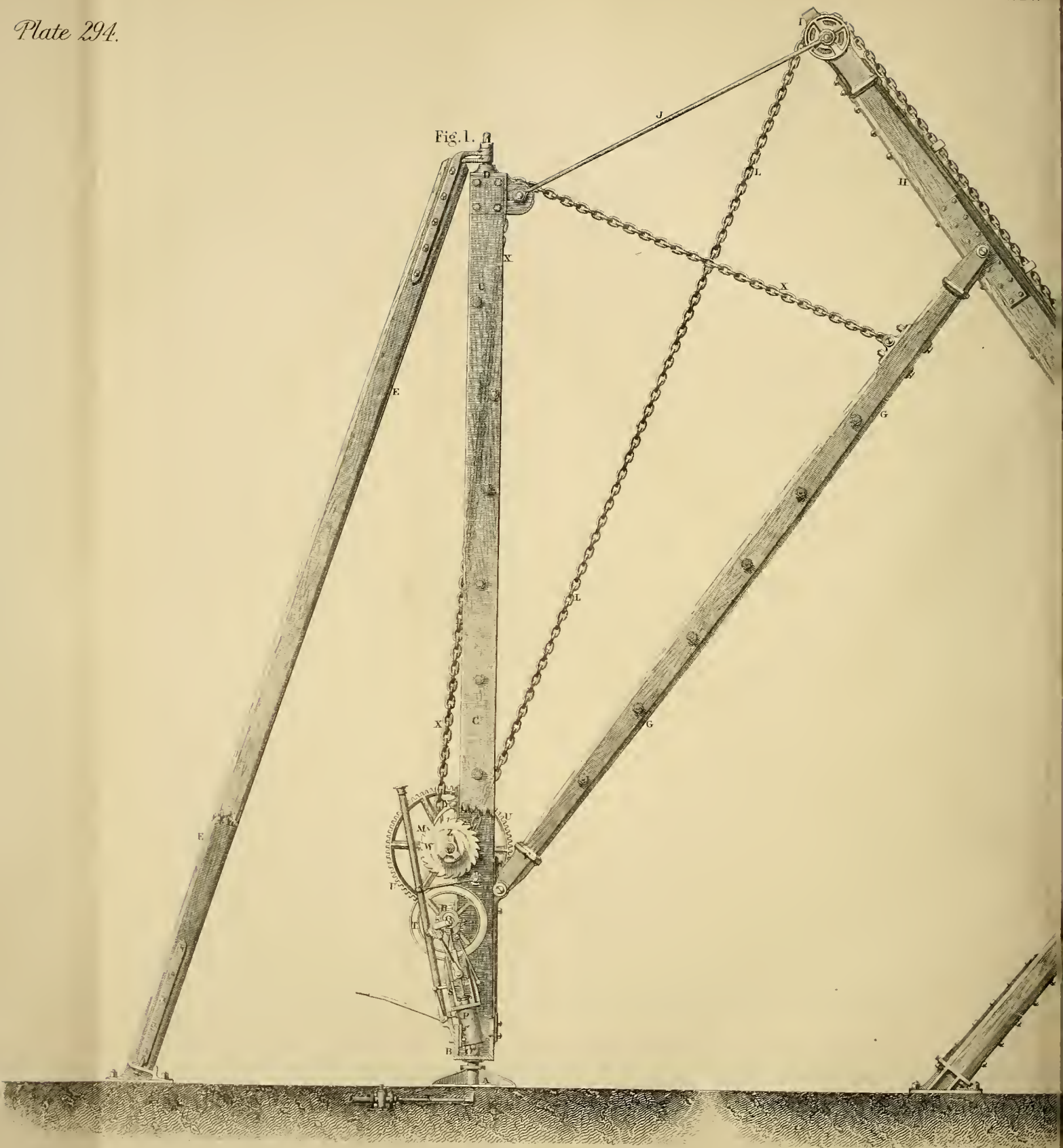
* The above is the substance of a communication made by James Nasmyth to section G, at the recent meeting of the British Association at Cambridge, Oct. 2, 1862.

STEAM C

BY Mr ANDREW

Plate 294.

Fig. 1.



ANE OR DERRICK.

CLAY. ENGINEER. KILMARNOCK.

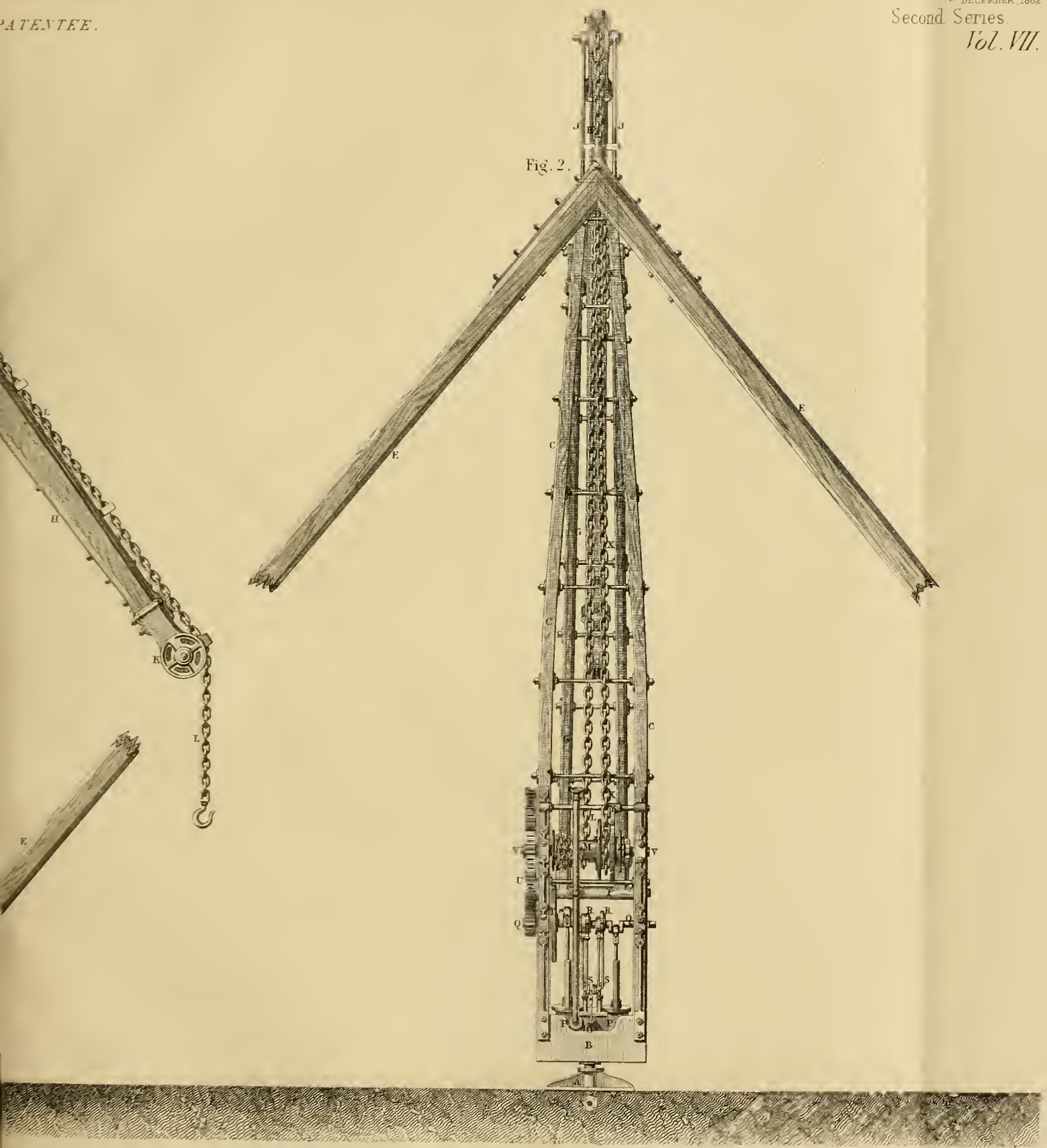
PATENTEE.

1st DECEMBER, 1862

Second Series.

Vol. VII.

Fig. 2.



Mackay & Kirkwood Glasgow

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STEAM CRANE OR DERRICK.

BY MR ANDREW BARCLAY, ENGINEER, KILMARNOCK.

PATENTEE.

Fig. 1.

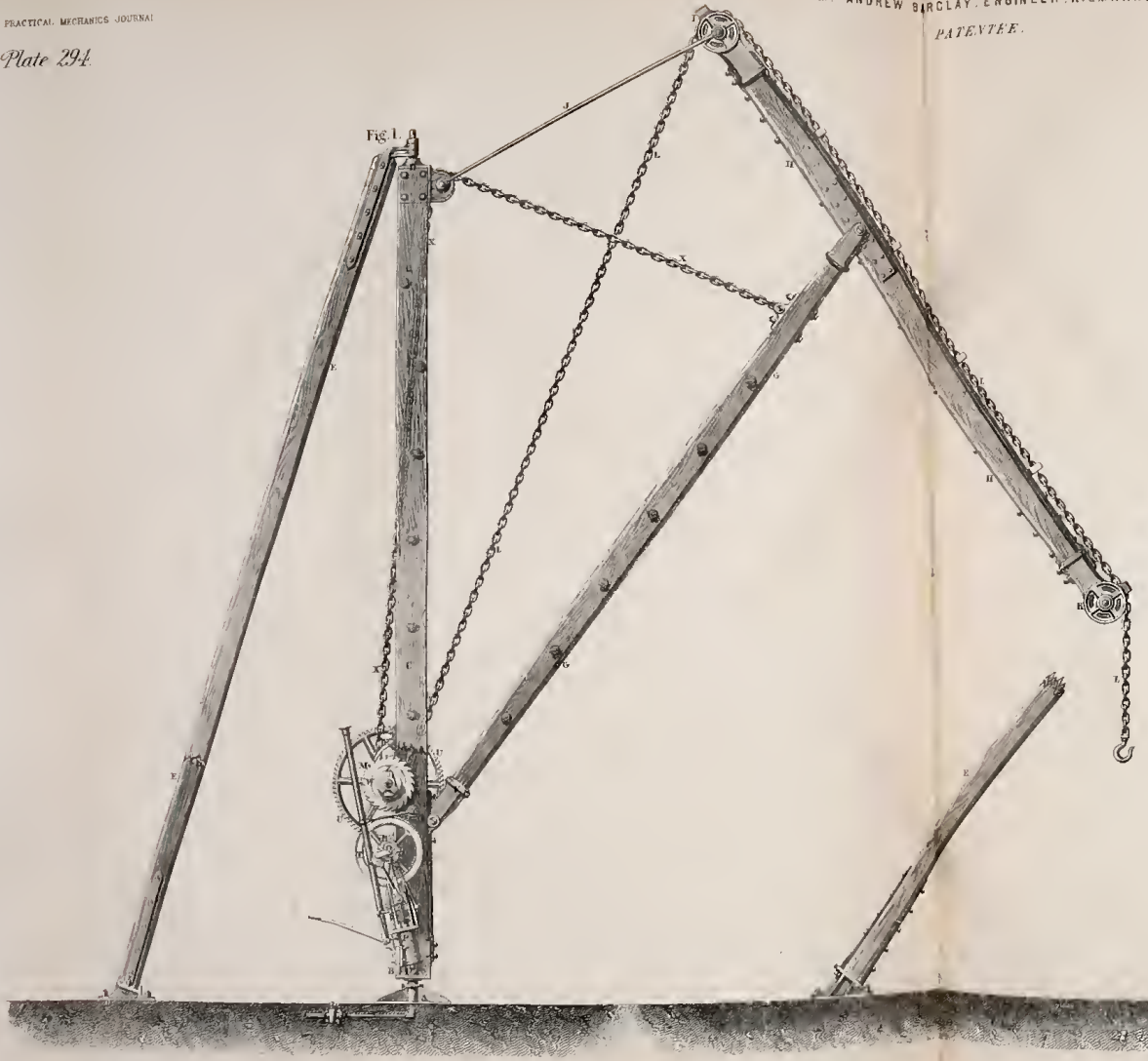
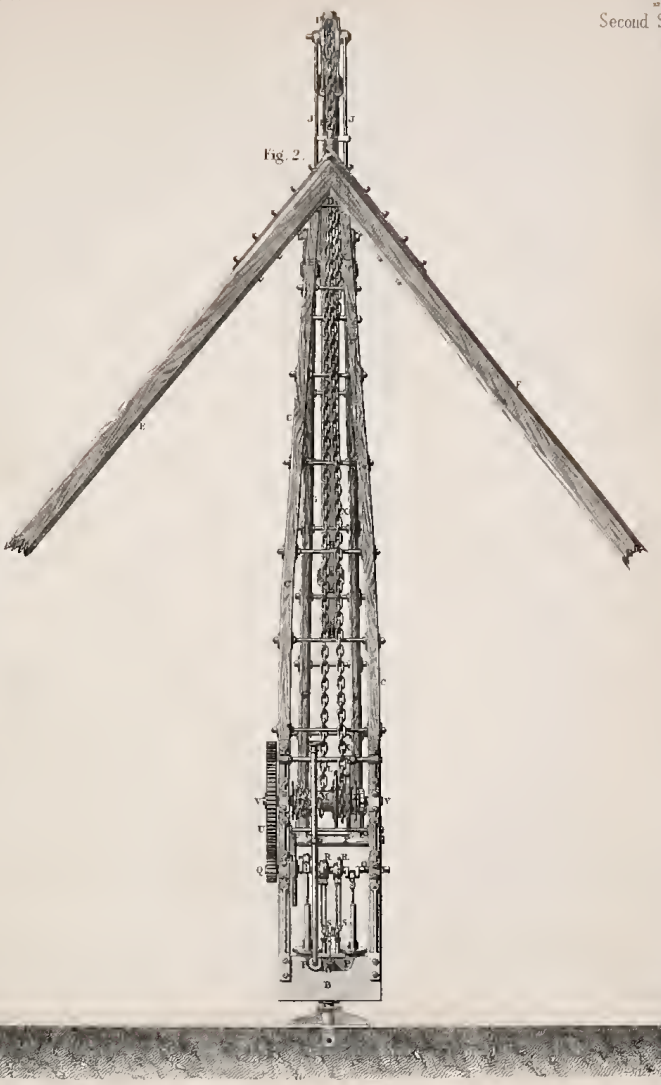


Fig. 2.



Mackay & Birkwood, Glasgow

upper extremity is fitted with an iron cap and pulley, I, the spindle of which is connected by the links, J, to the spindle of the pulley in the cap. D, of the pillar, C. At the lower end of the jib, H, is fitted the cap and pulley, K, over which the hoisting and lowering chain, L, passes; this chain is carried from the winding barrel, M, upwards over the pulley, I, and downwards to the pulley, K, where it terminates with the usual hook and swivel for slinging the load.

In this modification the crane is shown as arranged to be driven by steam power, the moving parts being actuated by a small pair of coupled engines. The steam is conveyed from the boiler, which may be fixed in convenient proximity to a stationary crane, or upon the platform of a portable one, and passes by the pipe, N, up through the socket, A, and tubular pivot to the valve casing, O, and from thence into the cylinders, P, the piston rods being connected in the usual way with the driving shaft, Q. Each engine is fitted with a pair of eccentrics, R, and link motions, S, which are operated by the hand lever, W, arranged as shown, or in other manner, to be within convenient reach of the attendant, and enable him to drive the engines either forward or backward as required. On the shaft, Q, and inside the frame of the pillar, C, is keyed the fly wheel, T, and on the outer extremity of the shaft is a pinion which gives motion to the wheel, U, on the winding barrel, M, on which the chain, L, is wound. Outside the barrel, M, and running loosely on the shaft, Y, to which the barrel, M, is keyed, is a small barrel, W, on which the chain, X, is wound on the barrel in a direction contrary to that of the chain, L, on the barrel, M. The chain, X, is carried upwards and over the pulley, D, its extremity being attached to a transverse bar carried in the brackets which are bolted to the jib, G, the office of the chain, X, being simply to lower or draw in the jib, G, which causes the load on the chain, L, to be carried either outwards or inwards in a horizontal line; that is to say, if it is required to move a load from a wharf to the hatchway of a vessel lying alongside, the barrel, W, is coupled with the shaft, V, and the engines are set in motion so as to wind in the chain, X, and bring the jib, G, nearer or quite to the vertical position. The movement of the jib, G, also brings the end of the jib, H, inwards, which moves with accelerated velocity. The load is attached to the hook of the chain, L; the action of the engine is reversed so as to run out the chain, X, and allow the jib, G, to descend; this movement carries the load with a rapid sweep over the hatchway; the barrel W, is uncoupled, while the winding barrel, P, is caused to turn in the opposite direction to pay out the chain. L, and lower the load into the hold. From the arrangement of the chains, L and X, the movement of the end of the jib, H, and consequently of the load, is always in a horizontal direction, for just as the chain, X, is caused to affect the movement of the jib, G, the chain, L, is given off or wound on to the barrel, M, to compensate for the alteration in the angular position of the jib. H. The outer flange of the barrel, W, forms a ratchet wheel, into the teeth of which the pawl, Y, falls; this pawl is carried on a transverse spindle extending across the main pillar, C. Outside the ratchet wheel is a coupling keyed on the shaft, V; this coupling is made with a disc, Z, having a rounded rim, by means of which the attendant causes the barrel, W, to rotate or not with the barrel, M, according to the required movement of the jib, G. To prevent accidents or breakage of the parts in case the engines should be set in motion in the wrong direction, the teeth of the coupling are hinged so as to move out of the way and allow the coupling to rotate without injury. For hoisting and lowering the barrel, M, is alone required, but when the load has to be moved to and fro in a horizontal direction, or nearly so, then the barrel, W, must be brought into requisition to effect the necessary movement of the jib, G. From the rapidity with which the end of the jib, H, moves to and fro, the operation of moving loads from one point to another within its range may be effected with much greater facility than by means of the ordinary crane, as well as with greater economy of space.

These cranes may be arranged either for stationary or portable purposes, and so as to be actuated either by steam, hydrostatic, or manual power, and are applicable for all the purposes of lifting or moving heavy bodies, and may be readily fitted on portable wheeled carriages, if required.

MESSRS P. FAIRBAIRN & CO.'S TOOLS.—GREAT EXHIBITION.

In the *Exhibition Record* Article on Tools, it was remarked by the author of that article, in reference to a large vertical drilling machine, exhibited by the above firm, that "though in most respects a fine example, it had some real *malformation* about the *friction-roller* at the base of the central pillar."

From explanations, since afforded by the above firm, to the author of that article, he finds that he did an unintentional injustice, which he hastens to amend. What externally appears as the axis of a small friction roller, and which he was misled by assuming to be one, is it appears, a pinching bolt, to set fast the rack.—Ed.

RECENT PATENTS.

POWER LOOMS.

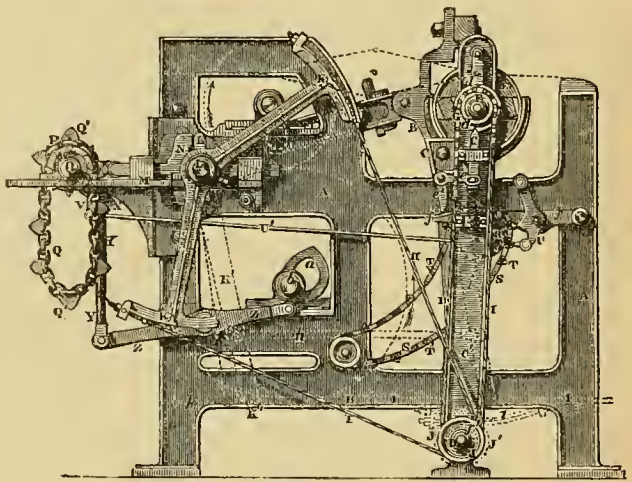
David Chalmers, *Dundee.—Patent dated December* 16, 1861.

This invention relates to the arrangement and construction of looms which are more particularly adapted for weaving figured and checked fabrics; and these improvements principally consist of new mechanical arrangements for actuating the shuttle boxes in the required sequential order, so as to produce the predetermined effect in the woven fabric.

Fig. 1 of the accompanying engravings is an end elevation of a portion of a loom showing one arrangement of apparatus for actuating a rotatory or circular shuttle box; and fig. 2 is a plan showing a portion of the end of the loom corresponding to fig. 1.

The framing or end standards, A, of the loom, are of the ordinary kind. To the lathe, B, is attached a laterally projecting frame, e, the end standard, c^1, of which is carried on a prolongation of the rocking shaft, D.

Fig. 1.



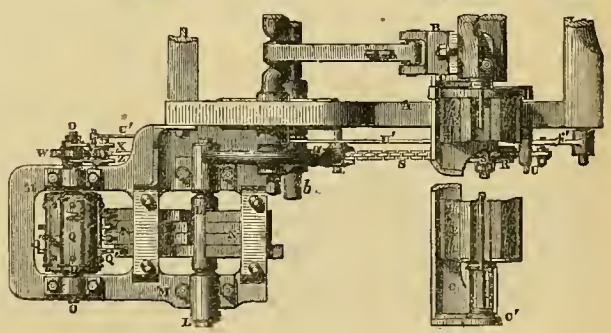


Fig. 2.

The rotatory shuttle box, E, which is carried in the frame, C, has the spindle at its outer end projecting out beyond the standard, e^1, of the frame, C, to admit of having fitted to it the chain wheel, F. Over this wheel a short length of chain, G, is passed, each end of which is connected to the wire cords, H and I. These cords are passed round the double-grooved pulley, J, which runs loosely on the extremity of the rocking shaft, D. The ends of the wire cords are carried up to and attached to the segmentally-shaped extremities of the duplex lever, K, which is fast to the horizontal shaft, L. The bearings of this shaft are carried in an open bracket frame, M, which is bolted to the end standard, A, of the loom framing; this frame also carries the modified jacquard mechanism for effecting the change of the shuttle box, E. The central part of the shaft, L, is made in the form of an open rectangular frame, in order to admit of the reciprocatory movement of a series of horizontal rods or bars, N, without interfering with the rocking motion of the shaft. The rods, N, slide to and fro in guides formed in the frame, M, and they are fitted at the backward ends with antifriction rollers; these rods correspond in number to the cells in the rotatory shuttle box, E, and in action they are equivalent to the needles of an ordinary jacquard apparatus. These rods or needles are of a T-shaped figure at the central part, the arms extending in a vertical direction and then bent at right angles, as shown in fig. 1, so that the extremities come into con-

tact with the cross bars of the rectangular frame of the shaft, L, when the same is pushed back. The bent ends of the T-shaped parts of the rods or needles, N, are so arranged as regards length, as to operate upon either the upper or the lower portion of the rectangular part of the shaft, L, and so that the duplex lever, K, may bring the desired cell of the shuttle box in a line with the shed. Immediately behind the rods or needles, N, is arranged a short horizontal shaft, O, carrying a chain wheel or barrel, P, on which is placed a short endless chain of metal plates or cards, Q. These cards, Q, are linked together, and each one has a projecting part or tappet, Q^1, formed on the face of it, which part moves forward one of the rods or needles, N, when a change in the pattern is required. The several cards, Q, are so arranged as regards the disposition of the tappets, Q^1, as to move the rods or needles, N, in the sequence required to produce the predetermined pattern. This arrangement of mechanism is brought into action partly by the reciprocatory movement of the lathe, and partly by a cam on the tappet shaft; at each forward movement of the lathe it actuates a lever, to which is attached a pawl that falls into the teeth of the ratchet wheel on the spindle of the chain wheel, R. Over this wheel, R, is hung the chain, S, and as the ratchet wheel is driven round tooth by tooth by the action of the lathe sword, the chain is taken up one link at a time, which is equivalent to a double traverse of the shuttle. To effect the change in the shuttle box, projecting pieces or tappets, T, are inserted at the proper intervals in the chain, S, which come in contact with the pendent lever, U, which is connected by a long link, U^1, extending backwards to a catch or pawl, V, that falls into the teeth of a ratchet wheel, W, arranged on the shaft, O, of the chain barrel, P. On this shaft, O, is also carried loosely a duplex pendent lever, X, the arms of which extend downwards on either side of the vertical pawl, V, as shown in figs. 1 and 2, and are connected by a pin to the pawl, V. The ends of the duplex lever, X, are jointed to a link, Y, which connects it to a rocking lever, Z, that is actuated by a cam, *a*, on the tappet shaft, *b*. Thus, so long as the links of the chain, S, pass over the wheel, R, the pendent lever, U, will not be affected by it, and the lever, Z, will simply move up and down as the cam, *a*, comes round, without shifting the chain wheel or barrel, P, because the pawl, V, in its normal position, is beyond the range of the teeth of the ratchet wheel, W. When, however, one of the tappets, T, intervenes between the chain wheel, R, and the pendent lever, U, the lever is pushed back, which draws with it the link, U^1, and causes the pawl, V, to fall into the teeth of the ratchet wheel, W. The pawl, V, being connected to the pendent lever, U, the barrel, P, with the chain of cards, Q, are moved round by the action of the cam, *a*, until another tappet, Q^1, is brought in, which alters the position of the rods, N, and these operating on the duplex lever, K, cause the shuttle box, E, to be shifted round to bring the required cell of the shuttle box, E, into a line with the shed. The projecting parts of the T-shaped portions of the needles, N, are so arranged as regards length in the lateral direction, that each rod or needle, N, puts the rectangular part of the shaft, I, into one or other of the four positions indicated by the dotted circles in fig. 1, and these positions of the shaft will cause the lever, K, to bring the several cells of the shuttle box into a line with the shed. During the weaving the shuttle box is held steadily by means of a spring catch, which is actuated from the pendent lever, U. The spring catch, *c*, is arranged in a vertical position, moving in small guides, and is pressed upwards by means of a helical spring, which keeps the catch up in contact with the notched disc, *d*, when the catch is not otherwise acted upon. At the central part of the catch, *c*, is a laterally projecting stud, which enters a slot in the lever, *e*, fixed on the outer end of a short shaft, carried below the shuttle box by the sword of the lathe. When the shuttle box is to be liberated from the catch, *c*, the pendent lever, U, which is connected to the lever, *f*, causes an inclined plane on the extremity of the latter to push back the pendent lever, e^1, on the inner end of the shaft which carries the lever, *e*, and so depress the catch, *c*, and liberate it from the disc, *d*. In this manner the shuttle box is liberated at the instant prior to the change being made in the pattern-governing mechanism, and is fixed again by the catch, *c*, falling into the notch of the wheel, *d*, just after the change in the shuttle box has been effected.

Two other modifications for effecting the instantaneous change of the shuttle box according to the requirements of the patterns, are also indicated in the end elevation, fig. 1; the new parts, as arranged in these modifications, being delineated in dotted lines. The shaft, L, and the frame, M, with the series of rods or needles, N, as well as all the parts connected with the shuttle box mechanism, remain the same as in the first modification, just described. On the extremity of the shaft, L, is fitted the pendent lever, K^1, which corresponds to the duplex lever of the first arrangement. The several positions which this lever assumes in shifting the cells of the shuttle box are indicated by the diverging lines terminating in circles, *k*, at the lower ends. The lever, K^1, is connected by the link, H, to the horizontal sliding bar, I, to which is attached an endless wire cord, which is carried twice round the pulley, J^1, and so gives motion to a wheel, J, which is formed in one with or keyed to the tubular boss of the pulley, J, which runs loosely on the rocking shaft, D. In these arrangements the chain wheel, F, and the pulley, J, may either be carried on the outer side of the end standard, C^1, or on the inner side, so as to allow of the lever, K, and rack mechanism being arranged near the main frame, A, of the loom. The chain, G, in this instance, is made an open endless chain, and is passed round under the pulley, J, and over the pulley, F, on the spindle of the shuttle box, E. In this way, as the pendent lever, K^1, is moved by the positions of the rods or needles, N, the horizontal slide or rack, I, causes the pulley, J^1, and chain wheel, J, to be turned more or less, and so bring the required shuttle into use.

Another arrangement of equivalent apparatus, which is shown also in dotted lines, consists of the pendent lever, K^1, keyed to the shaft, L, and actuated by rods or needles, N. This lever is shorter, and moves through less space, as indicated by the circles, k^1, where it is connected by the link, *h*, to the pendent segmental lever or rack, *i*, by means of which the small pulley or wheel, j^1, on the boss of the chain wheel, J, is turned, so as to bring the desired cell of the shuttle box into use. In lieu of the wire cord slide and segmental actions, I and *i*, the same effect may be obtained by means of a toothed rack and segmental wheel acting upon toothed pinions in place of the pulleys, J^1 and j^1.

Either of these mechanical arrangements may be modified to suit a six-celled or other number of shuttle boxes, and by trifling modifications to actuate the vertical drop boxes, as well as those of the rotatory class.

Fig. 3 is an end elevation of a loom, showing another modification of mechanical arrangement for actuating the rotatory shuttle boxes, and fig. 4 is a partial front elevation corresponding to fig. 3; only those

Fig. 3

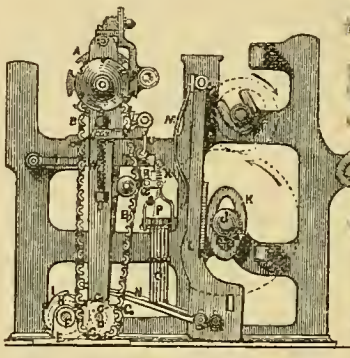
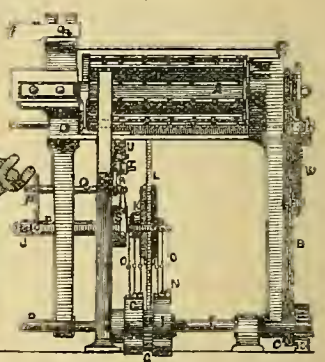


Fig. 4.



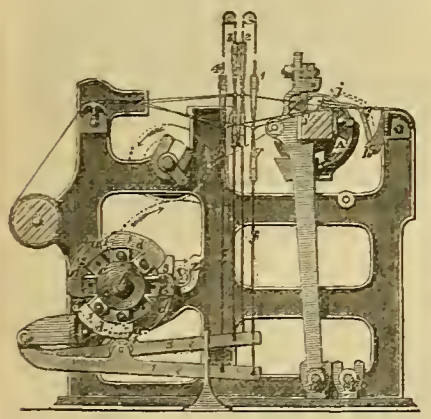
parts of the loom which are necessary to explain the shuttle-box movement are shown. The shuttle box, A, on each side of the loom, is arranged as described in the former modification, having at its extremity a chain wheel, over which is passed the endless chain, B. This chain is carried down and passes under the chain wheel, C, carried loosely on the end of the rocking shaft, D. Outside the wheel, C, and made fast to it, is a small pinion, C^1, also loose on the shaft, and which derives its motion from the toothed wheel, E. The wheel, E, is keyed to a shaft, F, which is arranged parallel to the rocking shaft, and extends across the loom to the opposite side, where there is a corresponding arrangement for actuating the other shuttle box. The rocking shaft also carries loosely upon it a ratchet wheel, G, having six teeth, or curved indentations, corresponding to the number of cells in the shuttle boxes. The ratchet wheel, G, has keyed to it a small spur wheel, which is indicated by a dotted circle, G^1, in fig. 1. This wheel gears with a corresponding sized wheel, H, keyed to the ratchet wheel, I, which is also fast to the shaft, F. On the tappet shaft, J, is a double cam, K, which imparts an oscillatory movement to the lever, L, pendent from a laterally projecting stud in the end standard. The lever, L, is kept pressed up to the cam, K, by a blade spring, M, or other equivalent therefor. To the lower part of the lever, L, are attached six pawls, N, the three shortest of which act on the ratchet wheel, G, and the three longest on the ratchet wheel, I. These pawls are brought into action, so as to move round the shuttle boxes in the proper sequential order, by connecting them to the ordinary jacquard movement of the loom. Each of the pawls, N, is connected by a link, O, to a lever, P, arranged above, the free extremity of each lever being connected by a wire or other attachment, *p*, to the jacquard apparatus, which is so arranged as to lift the inner ends of the levers, P, in the sequence or order in which the different coloured wefts are required to be woven. All the pawls, N, are made of varying lengths, that is to say, the three outer ones which actuate the wheel, I, on the shaft, F, are made one longer than the other, so that when brought into action the shorter pawl moves the wheel, I, round equal to the distance between one cell of the shuttle boxes to the next. The second or intermediate pawl causes the shuttle boxes to move round to the extent of two cells; and the third or longest pawl moves the shuttle boxes through half a revolution, or to the extent of three cells. The three pawls which actuate the wheel, G, on the rocking shaft, D, are arranged in a corresponding manner, so as to give three several degrees of rotation to the ratchet

wheel, G. This wheel being loose on the rocking shaft, D, the partially rotatory movement of the wheel is communicated by the contiguous wheel, G¹, to the wheel, H, on the shaft, F. The movement thus imparted to the shaft, F, is in the opposite direction to that given by the wheel, I, to the shaft, so that three cells of the shuttle boxes are brought into action by a motion in one direction, and the other three by an opposite motion. As the pawls are caused to act in succession upon the ratchet wheels, the shaft, F, is caused to rotate to a corresponding degree, and this motion is communicated by the wheel, E, on its extremity to the pinion, C¹, and chain wheel, C, which draws round the chain, B, and so brings the proper cell of each shuttle box into a line with the shed.

Between each movement of the shuttle boxes, they are held by a spring catch arrangement, similar to that before described, but modified to suit the arrangement of the pawls, N. A small shaft, Q, supported in pendent brackets, has fitted on one of its extremities a bell crank lever, R, the lower arm of which is connected to the stirrup piece, S, through which the levers, P, are passed. When the jacquard apparatus acts upon either of the levers, P, the stirrup, S, is depressed, which causes the bell crank lever, R, to raise the lever, T, and this acting on the roller of the lever, U, which is made fast to the same spindle as the bent lever, V, causes the latter to depress the spring catch, W, and so liberate the shuttle box, A. When the pressure of the lever, P, on the stirrup, S, is removed, the helical spring, X, draws up the arm of the bell crank lever, E, or when the lathe comes back allows the lever, U, to get clear of the end of the lever, T, and so causes the catch, W, to spring into the notch of the disc or wheel of the shuttle box, and hold it until another change is made. A corresponding arrangement is fitted on the opposite side of the loom, which is operated by a simple lever or arm on the other end of the shaft, Q.

Fig. 5 is a sectional elevation of a loom, showing an improved mode of actuating the treadles, so as to operate the heddles in certain predetermined sequences, and thus produce a twill or pattern in the cloth.

Fig. 5.



On the ordinary tappet shaft, Y, is a pinion, Z, which gives motion to a wheel, *a*, keyed on a short supplementary shaft, *b*, running parallel with the shaft, Y. On the shaft, *b*, is a compound cam, shown in enlarged edge view in fig. 6, for depressing the treadles in the required order or sequence. The cam is formed by preference of four discs, *c*, to which are bolted the segmental plates, *d*, which act on the rollers of the treadles, *e*. In this arrangement there are four discs, *c*, the segmental plates of each one serving to depress the corresponding treadle, *e*, immediately beneath it. Each of the discs, *c*, has bolted to it two of the segmental plates, *d*, so that each treadle is depressed twice during one revolution of the cam wheel.

In the accompanying engraving the plates. *d*, attached to the discs, 1 and 2, are shown in sharp black lines, and figured 1 and 2, whilst those on the disc, number 3 and 4, are shown in dotted lines. The treadles

Fig. 6.

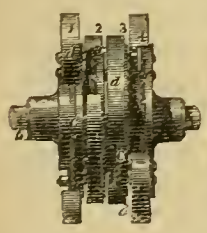
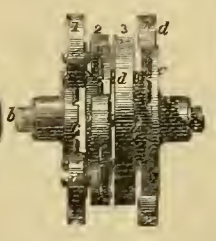


Fig. 7.

Fig. 8.



are attached in the usual way by the cords, *f*, to the heddles, *g*, which are numbered in accordance with the operating cams. With the cam wheel arranged in this manner, the following would be the sequence of the shedding movements:—With the cam wheel in the first position, or that shown in the engraving, the treadles, 1 and 4 are down, and the heddles, 1 and 4, are in a corresponding position, 2 and 3 being up. As the rotation goes on, 1 and 3 will be down, and 2 and 4 up; next 3 and 2 down, and 1 and 4 up; then 2 and 4 down, and 1 and 3 up; this completes the sequence, and the movements are repeated. In the arrangement shown in figs. 5 and 6, the segmental plates, *d*, are all of one size, and are each equal to one-fourth of the periphery of the discs, *c*, but another modification may be arranged by combining together segmental plates of unequal length, and so produce a different pattern in the weaving, An arrangement of this kind is shown in figs. 7 and 8; fig. 7 is a front view of the cam wheel; and fig. 8 is an edge view of the same. The longer segmental plates are equal to one-third of the periphery of the discs, whilst the shorter ones are only one-third of the length of the longer plates. Thus as the longer cams pass over the rollers of the treadles, they are kept down three times as long as those which are meanwhile operated by the shorter cams; this change in the shedding producing a different pattern to the other modification. The sequence in which the heddles are operated by this arrangement is, first, numbers 1 and 4 down, and 2 and 3 up; 4 and 2 down, and 3 and 1 up; 2 and 3 down, and 1 and 4 up; 2 and 4 down, and 1 and 3 up; 4 and 1 down, and 2 and 3 up; 1 and 3 down, and 2 and 4 up; 3 and 2 down, and 1 and 4 up; lastly, 3 and 1 down, and 2 and 4 up, which completes the order of operation.

In weaving jute carpeting, and other similar heavy fabrics, the weft is drawn tight by the shuttle, and when this is beat up by the reed the tightening action very frequently causes the weft to cut through the salvage of the cloth, sometimes to the extent of half an inch. To obviate this evil, the small apparatus delineated in fig. 6, and in plan in fig. 9, is added to the loom. Extending across the loom is a small shaft, *h*, which is carried in brackets projecting inwards from the breast beam just inside the loom, and to this little shaft are fixed by pinching screws two small bent arms, *i*, which extend over the cloth just in front of the fell, and are bent at right angles as shown in fig. 9. The extremity of each of the arms, *i*, is furnished with a pin, *j*, which passes down between the warp threads a short distance inwards from the selvage. When the shuttle is driven through the shed, it passes behind the pins, *j*, and the weft also, so that these pins cause a certain amount of slackness in the weft by reason of their distance from the fell, and so prevent the weft from being drawn tightly from the selvage by the rapid motion and drag of the shuttle. When the lathe is brought forward to beat up the weft, the projecting tappet, *k*, in front of the lathe, comes in contact with the contiguous arm, *i*, and so raises the pins, *j*, out of the warp, as shown in the dotted position of the arm in fig. 5, and thus allows the shot of weft to be properly beaten up. In this manner, by arranging properly the position of the pins, *j*, the requisite degree of slackness to be given to the weft may be regulated with the utmost precision, and an unbroken and uniform selvage always insured.

Fig. 9.

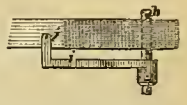
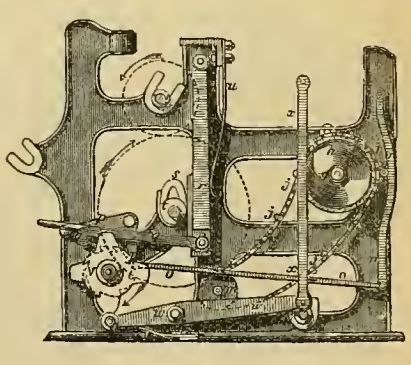


Fig. 10.

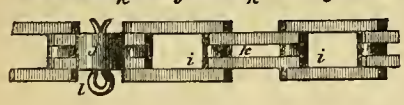


Lastly, this invention comprehends a modification of the movement and application of the pattern chain first described, for the purpose of regulating the vertical reciprocatory movement to a drop shuttle box. This modification is shown in the end elevation, fig. 10, as adapted to a two-celled shuttle box. On the small shaft, *g*, is fitted the chain and ratchet wheel, *h*. Over this wheel is carried the pattern chain, *i*, which has inserted at intervals in it the studs or projecting tappets, *j*. A portion of the chain is shown drawn to an enlarged scale in figs. 11 and 12, which are an elevation and plan respectively. The open links which take on to the teeth of the chain wheel, *h*, are connected by means of two flat links, *k*, having a small washer placed between them to fill up the intervening space, a pin being passed through the whole. Each open link of the chain is equivalent to a shot of weft, and when a change of the shuttle box is required, it is obtained by simply inserting one of the small studs, *j*, between the links, *k*, and fastening it by means of a split key, *l*, and in this way the chain may be adapted with ease and rapidity to suit any particular pattern required, and in connection with either rotatory or drop shuttle boxes. The endless chain, *i*, is carried over a lower wheel, *m*, to keep the lower portion out of the way; as the chain is carried round link by link with the action of the loom, when a stud, *j*, intervenes, it comes in contact with the roller in the pendent bent lever, *n*, and pushes the latter back. The lower end of this lever

is connected by a long rod, *o*, to a bell crank lever, *p*, which has a stud projecting laterally from its free extremity. On this stud a prolongation of the pawl, *q*, rests, the pawl being connected to the pendent lever, *r*; the prolongation serves to support the pawl, and allow it to vibrate freely to and fro. The lever, *r*, is actuated by the cam, *s*, on the tappet shaft, *t*, and is kept in contact with it by the blade spring, *u*. Whilst the open links of the chain are passing over the wheel, *h*, the pawl merely moves to and fro without affecting the position of the boxes; but when one of the studs, *j*, acts on the pendent lever, *n*, it depresses the hooked end of the pawl, *q*, and causes it to take into the teeth of the ratchet wheel on the back of the cam, *v*, and draw it round so that the projecting parts of the cam are removed from the roller of the lever, *w*. The other end of this lever is connected to the rod, *x*, which operates the two shuttle drop boxes. Thus, when the cam, *v*, is in the position shown in fig. 10, the lever, *w*, being depressed at the backward extremity, the lower shuttle box is brought into use, and the weaving will go on in this way until a stud shifts back the lever, *n*, which draws the projecting part of the cam off the roller of the lever, *w*, and this being liberated, the spring, *y*, raises it instantly, and it rests against the inner portion of the cam, *v*; in this position the front end of the lever, *w*, is depressed, which brings the upper shuttle box into operation. By increasing the number and varying the heights of the projections on the cam, *v*, the rod, *x*, may be caused to rise and fall so as to suit the movements of a "drop" shuttle box having a greater number of cells than the foregoing modification.

Fig. 11.

Fig. 12.



With these several improvements in the mechanical arrangement of looms, the manufacture of various kinds of striped, checked, and figured fabrics is greatly facilitated, and the working of the loom is extended.

WINDOW BLINDS.

The Rev. G. Scratton, *Stickney, Lincoln.—Patent dated April* 2, 1862.

This invention relates to improvements in shades or blinds, for keeping the sun's direct rays off windows, or the interior of apartments, the principal objects being the obtainment of an improvement in the appearance of such blinds, whilst they admit a great amount of light through the windows, and permit of an agreeable prospect outwards. The improved shade or blind is composed of a series of narrow frames covered with any suitable blind or shade material, each frame being disposed vertically, and at a distance asunder, somewhat less than the width of the frame, the set forming a row in front of the window to be shaded. These shade or blind frames are sustained in position by pairs of parallel horizontal bars into which each frame hinges one edge of each frame into one bar, and the other into the fellow-bar. These bars are of equal length, and are fastened by turning-pins (except in cases where the edges of one of the shades, at each side of the window become the turning pins) to brackets or cross pieces fitted on to perpendicular spindles or side bars, one spindle or bar being placed on one side and one on the other side of the window. The spindles or bars turn freely in fixed brackets made to receive their ends or axle-pins at the ends.

If the shades are intended to be removable, the irons or brackets must be fastened to a perpendicular piece—one on each side, which pieces fasten and unfasten with hand screws, or studs and slots to the window cords, or otherwise, as the case may be. These perpendicular pieces may be joined at the top and bottom so as to form a light frame.

In some cases where there are no shutters or other impediment, the irons or brackets may be straight and parallel to the wall in which the window is placed, but in other cases they must be parallel to the wall for a short distance, and then bent at right angles, straight or bent brackets being used, according to circumstances.

Ordinarily the shades are fitted into two pairs of horizontal bars as aforesaid, one pair on a level, close to the lower ends of the shades and the other pair on a level, more than half-way up the shades.

The shades are opened and closed or set to whatever inclination is required, by turning the spindles or vertical side bars on their axis. Whatever motion is given to one spindle or bar is communicated to the other, and to all the intermediate shades simultaneously.

It is proposed to turn the blinds by means of a grooved quadrant or semicircle, attached to each of the two vertical spindles or bars from which a cord passes over a fixed guide pulley. These cords serve by pulling first one and then the other to open or close the blinds, one drawing them open from the left, and shutting them on the right, and the other drawing them back again, until they are closed on the left. If desired, the pulleys and quadrants may be dispensed with, and the blinds may be made loose enough to turn by the hand, upon the pivots or centres of the two side vertical bars or spindles. Each individual shade frame is simply constructed of a pair of thin round rods connected by suitable end, and intermediate cross pieces of wood or metal, to give stability to the frame. In constructing the shade frames in metal, tubular or semi-cylindrical hollow rods may be employed into which the requisite number of metal stays, such as wire bent into the desired form may be soldered or riveted.

Figure 1 of the accompanying engravings represents a front elevation of one form of improved sun shades or blinds constructed, in accordance with this invention, as adapted to a rectangular window, and fig. 2, is a sectional plan of the same. To the main frame of the window, is attached by thumbscrews, a light, secondary frame, or it may be two side standards, A, carrying the sun shade or blind. Near the top and bottom of the frame or standards, A, are fitted bracket irons or supports. These brackets are formed with tubular sockets into which work freely the pivots, or axes, upon which the two vertical side spindles or bars C, turn, and by which they are held in position. A metal plate, B, is screwed to each end of the bars, which has formed upon or fitted thereto the central pin forming the pivot or axis of the bar, and contains also two other pins, one at each extremity of the plate, which form the joint pins for the connection thereto, of the horizontal pairs of bars, D, which support and actuate the shades. In the modification shown in the engravings only one such plate and pair of rods, D, are shown at the top for actuating the shades, being supported at their base by a single bar. The ends of the bars, D, have metal eyes screwed thereto, the apertures of which fit the pins in the ends of the cross metal plates, and are retained thereon by small knobs or nuts screwed on to the end of the pins, thus forming the working joints for the parallel action of the rods, D. The shades may be of any desired shape—composed of a pair of light rods of wood, tubular or semi-circular metal, or other suitable material, united at the top and bottom and at one or more intermediate parts, if desired, by cross pieces, secured to the said rods in any convenient manner so as to impart stability to the frame. The several frames are connected to the horizontal bars, D, by passing their sides through metal eyes, let into the upper surfaces of the upper and lower pairs of bars, the frames being supported therein by small eyes embracing the edge of the larger eyes, and driven into, or otherwise secured to the sides of the frame. The cords with tassels at their ends for opening and closing the blinds, pass over guide pulleys and are secured to grooved segments or semicircles, which are fitted to the vertical side spindles or bars, C. These blinds may be fitted either to the outside or inside of the window-frame, and in place of being secured thereto, by thumbscrews, as described, the frame, A, containing the blind, and made larger, with returned sides, cornices, &c., may be made to slide laterally in grooves so as to be pushed to one side when not required for use. According to another modification the horizontal bars, D, may consist of slit tubes, either of metal or wood, and within these bars, are fitted to slide longitudinally and freely, a number of sliding pieces which carry the eyes connecting the frames to the shades. The shades in this case are connected together at equal intervals apart by cords or chains at or near the bottom and top ends thereof which will admit of their being drawn across the window, or close together on one side by strings passing along the slit tubes. It is also proposed in some cases to make the blinds double, that is, to employ two secondary frames, A, hinged to the sides of the window-frame, and made to open in the centre similar to a

Fig. 1.

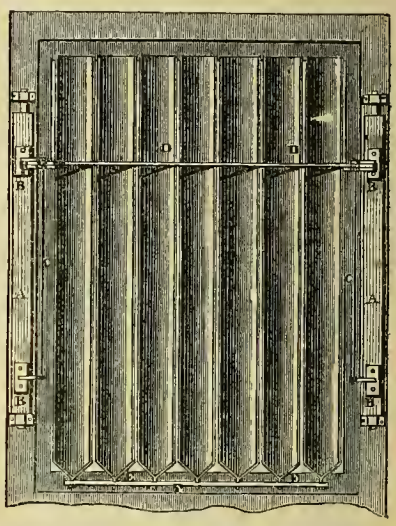


Fig. 2.

French window, each frame containing its own set of shades, or the horizontal bars may be made to divide in the centre, and admit of the blinds opening, the top and bottom bars being braced together, or so contrived that tugging or straining of the blind will be prevented.

In these figures is also illustrated a modification slightly different from that first described; a slightly modified form of sun shade, wherein only one pair of parallel adjusting bars are used.

In this arrangement, A represents a pair of uprights temporarily fitted in any convenient manner to the side of the window so as to be capable of being readily removable at pleasure, and provided with metal brackets B, carrying the spindles, C, the uprights, brackets, and spindles being all removable together; two of the adjustable parallel bars, D, which, in this case only open and close the shade, are supported on the upper brackets, B, which answer to the metal plates of the first arrangement, and are capable of being lifted off their centres or turning pins when desired. In this example the lower ends of the lever or shades are provided with central pins or pivots, E, which work in a bar, F, this bar serving to keep the shades at the proper distances apart. It may either be fixed to the window frame, and made to support the weight of the shades, or left free; in the latter case (as shown), it is sustained by rivets on the bottoms of the pivots. If desired a similar bar may be applied to the upper ends of the shades, or holes may be made in some projecting part of the window, above or below, to receive the pivots in lieu of having a separate bar. The shades being connected with the two parallel bars, D, near the top, by hooks and eyes, so that on lifting any one shade it may be removed from the rest by slipping its pivot at the lower end out of the bar, F, the nut or end on the pivot being previously removed. If desired the metal eyes before referred to may be fitted to a pair of subordinate lengths of parallel bars so as to admit of two or more shades being put up or taken out together, these bars being laid on the main bars, D, and kept in their places by studs and holes or otherwise.

SEWING MACHINE.

ALEX. M'KENZIE *and* F. PANTHEL, *Glasgow—Patent dated February* 7, 1862.

THIS invention relates to the arrangement and construction of sewing machines, which are so arranged that by a simple mechanical movement the sewing may be put in the fabric in lines at right angles to each other. In other words, the fabric may be sewn longitudinally, and then in the transverse direction, without requiring the fabric to be turned round, thus affording increased facility to the worker. The machine is also arranged to sew articles of a tubular kind, like boot legs, or circular seams, with greater convenience than heretofore.

Fig. 1, of the accompanying engravings, is a longitudinal vertical section of one form of this improved sewing machine; and fig. 2 is a plan or horizontal view, looking from the under side, showing the working mechanism; while figs. 3 and 4 are upper and under horizontal views of the spring presser foot, showing its form and mode of swivelling round to suit the longitudinal and cross sewing. Fig. 5 is an elevation of the lower part of another modification of spring presser. The table, A, of the machine is of the usual rectangular figure, and has bolted to it the overhanging arm, B, which carries the needle bar and spring presser at its outer extremity. The main or driving shaft, C, extends across the under side of the table, A, and carries on one of its extremities the fly-wheel, D, which has a laterally projecting handle, E, and is put in motion by the hand of the operator in the ordinary way. For increasing the speed of the machine, it is driven by a strap passed over the pulley, C^1, and round a wheel arranged beneath the supporting table, the second wheel being connected to and put in motion by a treadle. On the shaft, C, is keyed the main cam, F, which gives motion to the lever, G, centred on a stud in the arm, B, and connected at its outer extremity to the sliding or needle bar, H. The lower end of this needle bar is fitted with the ordinary arrangement for holding the needle, I, and adjusting it to the required position. The needle is supplied with thread or silk from the reel or bobbin, J, and its course to the needle is indicated by the line, K, in fig. 1. The table, A, has bolted to it the tubular arm, L, which may be made to extend outwards in front of the table to any required extent. Within this tube is fitted the shuttle for securing the stitch together, with its carrier, and the mechanical arrangement for actuating the same; also the moveable feed-plate for carrying the cloth forward, and the means for actuating the same. The primary tubular arm, L, is enclosed by

Fig. 1.

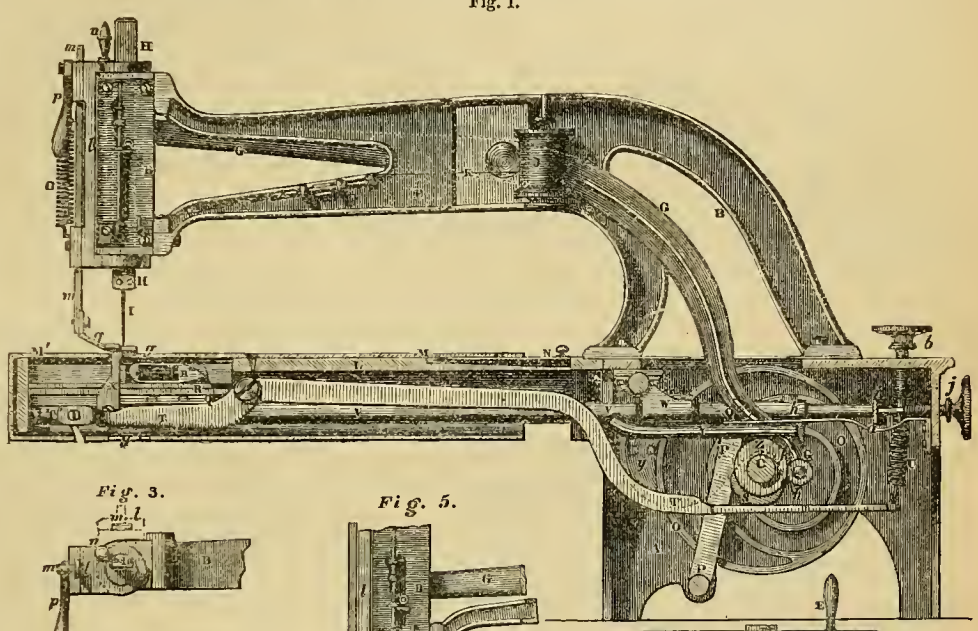


Fig. 3.

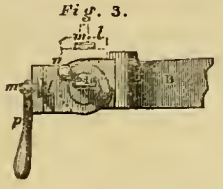


Fig. 5.

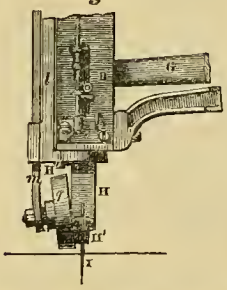


Fig. 4.

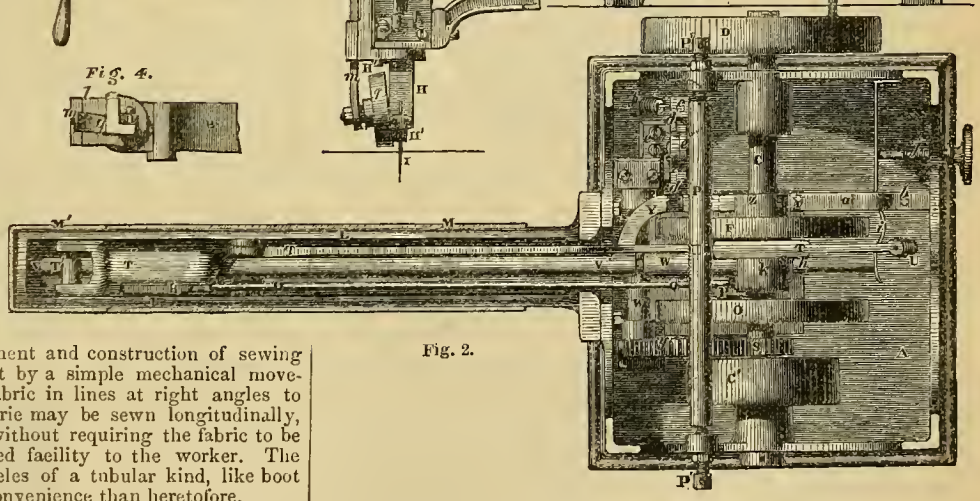


Fig. 2.

an outer brass tube, M, which is formed in two parts, the inner one extending over the greater portion of the tubular arm, L, and is fastened in the proper position by the spring catch, N. When this catch is free, and the little knob at its inner end is in the position shown in fig. 1, a small pin at the outer extremity of the catch enters a hole made for the purpose in the tube; there are two of these holes in the tube made opposite to each other, so that the tube may be fastened with either half of its periphery uppermost, the reason for which will be subsequently explained, The outer end of the tube, M, forms a cap piece, M^1, by removing which access is had to the shuttle carrier for placing or removing the shuttle. On the shaft, C, is arranged a cam, O, grooved on its inner face like the cam, F, and fitted parallel thereto. This cam is grooved in such manner as to impart the necessary throw or reciprocatory movement to the shuttle carrier, through the medium or by means of an inverted T-shaped lever, P. The horizontal part of this lever extends across the table, A, as is more

clearly shown in fig. 2, and is supported by the screws, P¹, which pass through snugs cast on the lower part of the table. A. The pointed ends of the screws, P¹, enter the extremities of the horizontal bar of the lever, P, and the screws are tightened up by the jaw nuts when the proper adjustment of the lever is obtained. The central stem or vertical part of the lever, P, extends upwards, and is connected to the rod, Q, which extends along the tube, L, and is attached to the brass sliding piece or carrier, R, in which the shuttle is traversed to and fro. The central stem of the lever, P, has a laterally projecting stud, on which is carried an antifriction roller, that traverses in the groove of the cam, O, so that the rotatory movement of the cam causes the rod, Q, and the carrier, R, with its shuttle, to traverse to and fro immediately after the needle is depressed and is carried up out of the cloth by the movement of the needle bar. The shuttle carrier, R, is by preference formed of brass, and it traverses to and fro in a guide fitted in the outer end of the tube, L. The shuttle, R¹, is formed of steel, and is of the kind ordinarily employed in machines of this class, that is to say, it is of a boat-like figure, with a sharp pointed extremity for passing through the loop of the stitch formed by the needle. It contains within it a small steel bobbin and supply of silk or thread, the drag or tension of which is regulated by passing the end through one or more holes formed for the purpose in the upper edge of the shuttle. At that part of the tube, L, where the shuttle carrier traverses, the metal is cut away, forming a longitudinal slot, so that by removing the cap piece, M¹, of the tube and slipping back the inner portion of the tube, the opening in the tube, L, being immediately beneath, ready access is afforded to the shuttle carrier for shifting or replacing the shuttle. The compound motions for actuating the feed plate so as to carry the cloth forward at each stitch, are obtained from the shaft, C. On this shaft is a cam, S, which operates the lever, T. This lever is fulcrumed on a stud extending across the tube, L, and it is bent downwards at the backward part, extending beneath the cam, S, its extremity being connected to the spiral spring, U. This mode of fitting the lever, T, gives to it a rocking movement in a vertical direction as the cam, S, rotates, the front end of the lever being depressed by the contraction of the spring, U, when the cam is not affecting the lever. Throughout the greater portion of its length the lever, T, forms a thin flat bar, but at the part where it is fulcrumed the metal is extended laterally and hollowed on the upper side, terminating in a forked extremity, in which is fitted a tubular bearing piece, T. This bearing receives the end of the rod or spindle, V, the inner part of which is supported by the pendent bearing, W, that is bolted to the under side of the table, A. The rod or spindle, V, has screwed to it, near the front end, the serrated feed plate, X, which passes up by the side of the shuttle carrier guide, the serrated part of the feed plate extending over the guide to some extent, and working to and fro in the slot formed in the inner portion of the tube, M. The rod, V, has, diverging from it in a lateral direction, the arm, Y, which is bent round the cam, F, and is operated by the cam, Z, on the shaft, C. At every rotation of this cam it lifts the arm, Y, and so causes the spindle, V, to turn on its axis, which the arrangement of the tubular bearings, T and W, readily admits. This partially rotatory movement causes the feed plate to move forward in a lateral direction, which carries the cloth forward the extent of a stitch. The feed plate is brought back to its normal position by the pressure of a blade spring, *a*, acting on the upper side of the arm, Y. The pressure of this spring is regulated by the screw, *b*. The movement of the rod, V, about its axis, which has the effect of carrying the cloth across the tube, M, or in a direction at right angles to its length, is regulated by the screw, *c*, which is arranged so as to be within convenient proximity to the operation. The end of this screw presses upon the small lever, *d*, which is centred on a stud carried in a bracket piece, *e*, pendent from the under side of the table, A. The free end of the lever, *d*, is bent so as to press upon the arm, Y, when caused to do so by the screw, *c*, but when the pressure of the screw is taken off, the end of the lever is depressed, and so removed from the arm, Y, by the helical spring, *f*, which is attached to the lever, and to the under side of the table, A. Thus, when the regulating screw, *c*, is screwed upwards so as to be clear of the arm, Y, the pressure of the blade spring, *a*, keeps the arm up to the cam, Z, and the arm is depressed to the full extent of the eccentricity of the cam, and the greatest amount of lateral traverse of the feed plate, X, is obtained. With this extent of traverse of the feed plate the longest stitch is made, because the cloth is carried forward in accordance with the motion of the feed plate, X. To limit this motion, and so obtain a stitch of any required degree of fineness, the screw, *c*, is caused to press on the end of the lever, *d*, and so bring the free end of the lever in contact, or nearly so, with the arm, Y, which limits the circular motion of the spindle, V, and so shortens, or entirely stops, the lateral movement of the feed plate, X. A highly important feature in the arrangement of this machine is, that the operator is enabled to sew the fabric in two directions without altering the position of the cloth or other material; that is to say, the material may be sewn in a direction transverse to the tube, M, and then, by an easy adjustment of the moving parts, to sew in a direction parallel with the tube. To do this the spring presser is shifted round to the extent of a fourth of a revolution, as will be presently described, the tube, M, is shifted round half way, and the feed plate, X, is caused to move in the longitudinal direction of the tube. The inner portion of the tube, M, has brazed into it two slotted steel plates, *g* and *g*¹, and these openings are shaped to admit of the movement of the feed plate, X, in the transverse and longitudinal directions. The mode of obtaining and regulating the movement of the feed plate in the transverse direction has been explained. The opposite motion is obtained by depressing the stud of the spring catch, N, turning the tube half round, to bring the opening, *g*¹, under the needle, and imparting a longitudinal motion to the rod or spindle, T, and feed plate, X. This rod has a shoulder formed on it a little beyond the part which passes through the bearing, W, and on the backward end of the rod, which extends through the bearing, is fixed by a pinching screw the T-shaped end piece, *h*. The extremity of the horizontal part of this T piece is pressed forward by the blade spring, *i*, which is brought into action by the screw, *j*, that extends out through the table, A. The backward traverse of the rod is obtained from the cam, *k*, on the shaft, C, which acts on the vertical stem of the T piece, *h*. Thus, as the shaft, C, rotates, the joint operations of the cam, *k*, and blade spring, cause the feed plate, X, to reciprocate in the longitudinal direction. The length of the stitch is regulated by an inclined plane formed on the inside of the lever, *d*, and there is a similar inclined surface extending down from the underside of the arm, Y. When the rod, V, is working in the longitudinal direction, the faces of the two inclined planes come in contact, and by adjusting the screw, *c*, so as to admit of more or less traverse of the rod, V, the length of the stitch is regulated, thus one screw serves for the adjustment of the sewing in either direction. The arrangement of the swivelling spring presser is shown in elevation in fig. 1, fig. 3 being a plan of the same, and fig. 4 an underside view of the same. The end of the arm, B, which carries the needle-bar, H, is made with a cylindrical shoulder on the upper and lower ends, on which is fitted the frame-piece, *l*, carrying the spring-presser, *m*. This frame-piece, *l*, has a partially rotatory motion about the end of the arm, B, and it is retained in either of the two positions required for the longitudinal and transverse sewing by means of the pin, *n*, which enters holes made for the purpose in the end of the arm, B. Thus the frame, *l*, may be readily held either in the position delineated in fig. 1, which is the position for transverse sewing, or it may be shifted round as shown by the dotted lines in fig. 3, for sewing in the longitudinal direction. The spring-presser, *m*, slides up and down in the frame, *l*, it is pressed down upon the cloth by the helical-spring, *o*, and is raised by the cam, *p*, which, when lifted by the handle is pressed against the laterally projecting pin at the upper part of the presser, and is locked or upheld until the handle is again depressed. The serrated foot-plate, *q*, of the presser is of an L shaped figure, as shown in figs. 1 and 4, the inner angle of the plate serving as a guide to protect the needle, I, and prevent its being drawn out of the vertical position by the tension of the thread. Another modification of the spring-presser, in which the foot-plate takes the form of a wheel, is shown in side elevation in fig. 6. In this arrangement the spring-presser, *m*, has fitted to it the presser-wheel, *r*, which is arranged on its supporting stud in an angular direction, so that the upper part of the wheel is kept clear of the needle-bar, H. As the work is sewn, the wheel turns slightly on its axis, when the feed-plate, X, is carrying the cloth forward, and this movement facilitates the traverse of the fabric whilst being sewn. To the revolving frame, *l*, is fitted a small vortical guard, H¹, which extends downwards nearly to the tube, M, the needle passes down through the forked end of the guard which serves to prevent the deflection of the needle from the vertical position by the drag of the thread. The arrangement of the operating parts of the feed plate and shuttle-carrier, as hereinbefore described and shown, admit of the prolongation of the parts being got into a very small compass, so as to admit of the diameter of the tube, M, being greatly reduced to allow of narrow articles of the tubular kind being sewn with ease. The machine is also provided with a flat shifting plate, which is attached to the table, A, so as to convert it into an ordinary table machine. The two preceding figures show a modifica-

Fig. 6.

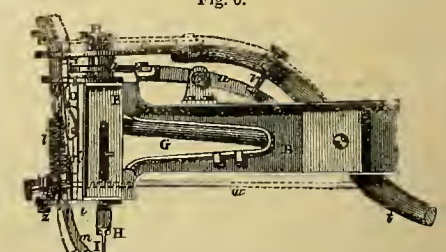
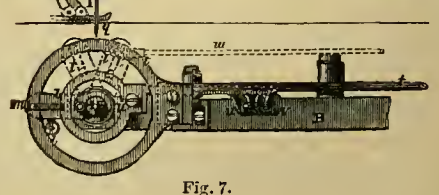


Fig. 7.



tion of the sewing machine, in which the feed or traverse of the cloth, or other material to be sewn, is effected by means of the spring presser. Fig. 6 is an elevation, and fig. 7 a plan corresponding, of the end of the overhanging bar, B, with another arrangement for feeding and shifting the spring presser at each stitch, and for producing the stitch known as the "herring-bone stitch." The frame, *l*, which turns partly about the overhanging bar, B, is slotted at the top and bottom to receive the presser, *m*, which is slotted at the central part, and is connected to the bracket, *n*, projecting from the front of the frame, *l*. Just above the bracket, *n*, is fixed a blade spring, *o*, the free end of which presses against the upper part of the presser and keeps the lower end directed inwards. The serrated foot plate, *q*, is jointed to the lower end of the presser, which arrangement facilitates the movement of the cloth as the presser makes its reciprocatory traverse. The to and fro motion of the presser is obtained from the main shaft, C, on which is a pinion, *s*. On the boss of this pinion, or keyed to the shaft, is a cam which gives motion to the lever, *t*. The lower end of this lever is forked, so that the cam first raises the lever and then serves to depress it. The lever is centred on a stud projecting laterally from the arm, B, above which it rises, and terminates in a ring which encircles the spring presser. The upward motion of the outer end of the lever, *t*, draws the spring presser, *m*, inwards, as shown by the dotted lines, and this motion causes the foot plate, *q* (which in this case is both a spring presser and feeder), to draw the material that is being sewn outwards to the extent of the traverse that is given to the spring presser. After the movement of the cloth or material in the outward direction is made, the presser, which is kept down upon the cloth by the helical spring, *l'*, requires to be lifted in order that it may resume its original position before a fresh stitch is made. This is done by means of the small lever, *u*, which is centred on a laterally projecting stud carried on the arm, B; the front end of this lever terminates in a ring which comes under a pin projecting in a backward direction from the upper part of the spring presser, *m*. The downward motion of the lever, *t*, causes the adjustable screw, *v*, to depress the lever, *w*, so that the ring at the front end coming under the pin of the spring presser, it is raised, and the pressure of the spring, *o*, brings the foot back to its normal position. In this way a regular feed or progression under the needle of the material to be sewn is effected. The "herring-bone," or "vandyke" style of sewing, is accomplished by causing the spring presser to take an angular position alternately to the right and left. The positions of the frame and spring presser in the extreme right and left traverses, are indicated by the dotted lines in the two positions in the plan, fig 7. A light connecting rod, *w*, is slipped over a pin, *x*, projecting up from the lower part of the swivelling frame, *l*. This rod extends backwards, and is connected to a slotted T-shaped lever, by means of which the length of throw or traverse of the swivelling frame may be regulated. The T-shaped lever is similar in its arrangement to the lever, P, shown in figs. 1 and 2. It is also fitted with an antifriction roller, which traverses in a groove formed in the face of the wheel, *y*, fig. 2, which wheel is driven by the pinion, *s*, at half the speed of the main shaft, C. The rotatory movement of the wheel causes the spring presser to be moved to and fro in an angular direction, and the cloth is moved in a corresponding manner, so that when a stitch is made the cloth and thread is carried in an angular direction, giving a zigzag or vaudyked appearance to the sewing. Several holes are formed in the upper part of the arm, B, and one is made in the upper plate of the frame, *l*, so that by means of a pin the spring presser may be fixed to sew in any desired direction. The spring presser, *m*, has formed on it a laterally projecting snug, through which the screw, *z*, passes. The end of this screw presses against the front of the frame, *l*, and by its means the traverse of the spring presser is regulated so as to make the stitching fine or coarse as required. With these several improvements, the working of sewing machines is simplified, and their range of operation may be extended to work for which they have hitherto been inapplicable.

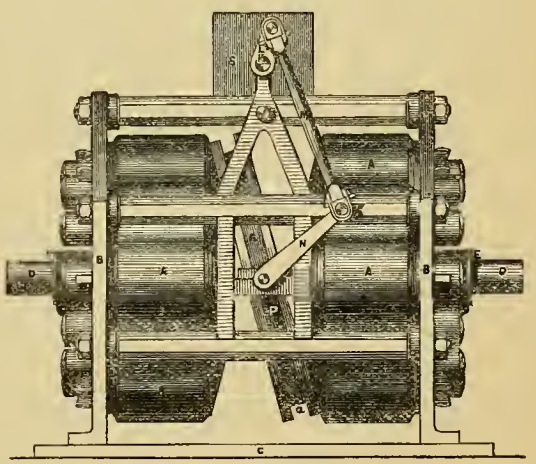
ELECTRO-MAGNETIC ENGINES.

G. F. Guy, *of Bury, Suffolk.—Patent dated March* 4, 1862.

This invention relates to a peculiar construction, arrangement, and combination of apparatus for obtaining motive power by the aid of electro-magnetism, and consists in the employment of one or more series of electro-magnets, arranged in circles, and made to act successively upon a ring of soft iron, which is caused to roll over their faces or poles. This ring is connected to the main shaft of the machine by any convenient and simple arrangement of universal joint which will permit of its gyrating in all directions round the shaft, whilst it is at the same time coupled thereto, so as to be incapable of rotating without carrying the shaft round with it. The poles or ends of the soft iron cores of the magnets are to be formed so that the faces will cover the wire lapping or coil with a shoulder, and all but touch each other, leaving a very small space between each magnet, to be filled with brass or other non-magnetic metal or substance, so as to make a smooth and unbroken surface, which is to be turned to the form of a truncated cone. The surface of the soft iron ring, which rolls upon the magnets, is to be turned to a hollow cone of a greater angle, and set upon the shaft, so that the apex of its coned face should coincide with the apex of the coned face of the circle of magnets if produced at their centre. Therefore, as the circumference of any part of this ring is larger than the path of the poles or faces of the magnets over which it rolls in proportion to the greater or less angular difference of the two cones, it follows that, at each roll, it will make a proportionate advance in the direction of its rotation; such advance being imparted to the main shaft of the machine; thus enabling the high velocity of magnetic action on the disc to be turned into power on the shaft, with an unlimited command of economy. In using two rings of magnets, it is necessary that the cones on both sides be exactly alike, also those of the faces of the disc or soft iron ring, and that all their apices should coincide at one centre in the middle of the driving shaft. It is advisable that the centres of the faces of the magnets of one circle shall be opposite to the division between the magnets of the other circle, and *vice versa*. Any convenient commutation may be employed for directing the currents into the several magnets in the proper order and succession as required, a continuous rotatory motion being thus obtained.

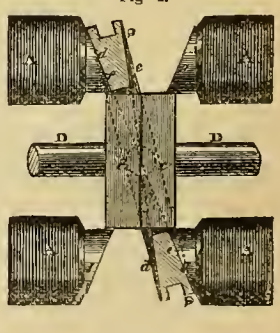
Fig. 1, of the subjoined engravings, represents a side elevation of one form of this improved electro magnetic machine, provided with two

Fig. 1.



circles or series of electro magnets. Fig. 2 is a corresponding vertical section of the same, showing the relative positions of the two sets or circles of electro magnets, and the gyrating or rolling armature or ring —the dotted lines showing the arrangement of the apices as before described. In these figs., A represents two sets or series of electro magnets, arranged in two circles, the soft iron cores being secured by keys or otherwise to the plates or side standards, B, of the machine, which are fixed in any convenient manner to a base-plate, C. Through the centre of these circles of electro magnets passes the main shaft, D, which works in bearings, E, in the end standards, B, respectively, and may be provided with a cogwheel or driving pulleys for the purpose of transmitting motion to any other pieces of mechanism required to be driven. Midway between the two circles of electro magnets, there is fitted on to the main shaft, D, an angular armature of soft iron, Q, which is connected to the shaft in such a manner that it will be free to gyrate thereon, but not free to rotate without carrying the shaft round with it. This connection is a universal joint of any simple construction — the one illustrated being as simple a form as any other; it consists of two trunnions or pins fixed inside the ring, Q, on diametrically opposite sides of the opening, and of two other trunnions or pins fitted to or formed on the main shaft at right angles to the first. *c*, are two metal plates having grooves, or channels, or bearings formed in them at right angles to each other, and of a depth sufficient to receive

Fig 2.



or enclose the two sets of pins when the two plates are screwed together. The result is, that the ring, Q, is free to turn upon the axes of this universal joint, which being at right angles to each other, admits of the ring performing gyrations round the shaft, whilst it is at the same time secured to the shaft by the inner set of pins or trunnions in such manner as to prevent it turning on its main central axis without carrying the main shaft, D, round with it. The two sides or faces of this ring are coned at *d e*, and the surfaces or poles of the several electro magnets are also coned as shown at *f g*, for the purpose of allowing the two sides or faces of the ring to roll in close contact with both sets of magnets simultaneously, the ring rolling over the several magnets in succession in each circle, and being consequently always in contact with one or other of the electro magnets in each series. Any convenient form of commutator may be employed for directing the current of the battery through the electro magnets in their proper order and succession, the object being to magnetize half the circle of electro magnets in advance of the path of the gyrating ring or armature, and to demagnetize them as fast as the ring passes over them, so as to produce a constant pull upon the opposite faces of the ring, and thereby cause it to roll over the magnets by describing a number of gyrations. As the conical paths over which the ring rolls are of smaller circumference than that of the ring itself, it follows that at each gyration the ring will advance or turn on its own axis a distance corresponding to the difference between the two circumferences, and consequently the greater this difference, the greater will be the speed of the main shaft. It is thus obvious that, by varying the angle of gyration so as to vary the relative proportions of the circumferences of the circles of magnets and of the ring, Q, the difference of the velocities of the disc and shaft will be proportionately varied. In the machine illustrated, the angle of the ring, Q, is such as to require twelve gyrations or rotations of the conical disc on the faces of the magnets to perform one complete revolution of the main shaft, but, of course, this may be varied to any desired extent, bearing in mind, at the same time, that the greater the angle the less will be the power, and *vice versa*. The patentee has shown a simple commutator which answers well for this machine, but he does not confine himself to any peculiar arrangement of commutator.

The commutator used consists of a wheel fixed on the spindle, K, which is rotated by means of small cranks, L, set at right angles to each other, and connected to rods, M, which are also connected to the larger vibrating arms, N, fast on the short spindles, O; these spindles are carried by a fixed portion of the framing, and are provided, on their inner ends, with a curved arm at P, carrying each a roller or slide block at the extremity, which roller works in a circumferential groove formed in the rim or outer periphery of the annular armature, Q. The gyrations of the armature are thus made to impart a vibrating motion to the arms, N, which transmit a rotatory motion to the smaller cranks, L, on the spindle, K, of the commutator. An ebonite ring is fitted on to the wheel or rigger on this spindle, and over this ring are fitted two semicircles of brass, a break being left between the ends of the semicircles. There are a series of rollers, equal in number to the electro magnets, A, in both circles. These rollers revolve in metal bushes, contained in ebonite blocks, which blocks slide in radial slots made in the two fixed supporting or carrying plates or cheeks. The blocks with their rollers are forced inwards so as to keep the rollers in contact with the brass semicircles by means of india-rubber, or other springs interposed between the outside of the blocks, and a projecting rim formed on the face of each plate. The connection with the battery is made through one of two brass rings, insulated from, but carried by, the commutator spindle, and situate one on each side of the commutator. One of these brass rings is connected to one of the semicircles by means of a wire or plate, and the other ring is connected with the other semicircle. On connecting one of these rings with the battery the engine moves in one direction; on disconnecting it and connecting the other, a reverse motion is obtained. At the breaks between the ends of the semicircles, insulated pieces of metal are interposed, or other provision made for preventing the rollers from dropping or sinking into the break as they pass over it. One end of the coil of each electro magnet is connected to the battery, and the other end to the bush of one of the rollers, the latter being arranged to follow one another alternately. Although the patentee has shown a double machine, namely, one having two sets or circles of electro magnets, it is obvious that the same may be made with only one set or circle of magnets, or two or more concentric circles of magnets may be used in each ring.

PRINTING BY ELECTRO-MAGNETISM.

C. W. Harrison, *Engineer, Walworth—Patent dated January* 7, 1862.

This invention relates to improvements upon or substitutes for the ordinary printing press, and stamping, beating, embossing, and perforating machines. In it the operating pressure or percussive force is obtained by the adaptation of electro-magnetic action, so as to secure an important saving in the labour and time ordinarily required in working such machines. In the case of the printing press, the tympan or actual impressing surface, when brought into its proper position over the types, blocks, plates, or other printing surface, is drawn forcibly down to give the required pressure by means of suitably-disposed electro-magnets or electro-magnets and keepers or coils of conducting wire. In some cases the inking rollers or ink-suppliers are also drawn upon the form of types, blocks, plates, or other printing surface used, so that impressions in a great variety of colours may be produced with great rapidity. A similar arrangement may also be used in the process of block-printing for fabrics.

As applied to machinery for stamping or beating gold, silver, and other metal-leaf or sheets, the present improvements are intended for producing effects equivalent to those of the ordinary hand-hammering process, which requires considerable time and skill. By means of suitable mechanical arrangements the operating-hammer or series of hammers are actuated by electro-magnetism, and the metallic sheet or leaf operated upon may be carried forward by a "step" electric motion.

In embossing and perforating machines, motion is given by electro-magnetism to a marker or perforator, which acts upon a moveable surface carrying the material to be operated upon.

Fig. 1.

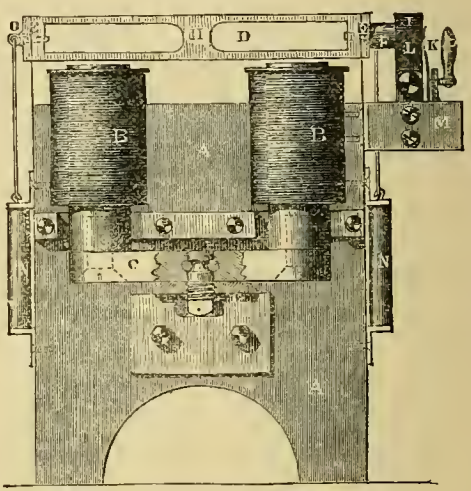


Fig. 2.

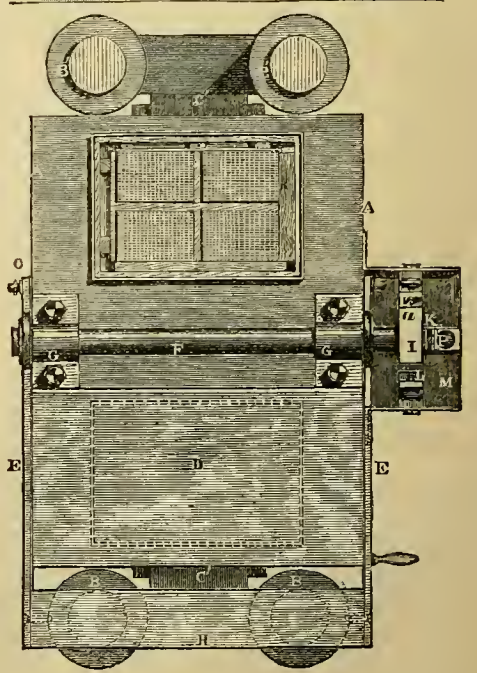


Fig. 1 of the accompanying engravings represents an end elevation of one form of improved printing press, constructed in accordance with this invention, and fig. 2 is a plan corresponding to fig. 1. The main rectangular frame, A, of the press is surmounted by the strong flat top or bed plates upon which the type is laid and fixed in form. This frame carries at each end the electro-magnets, B and B¹, supported by the brackets, C C¹, through which adjusting screws work for altering the position of the magnets. The platen, D, or actual impressing surface, is fixed between the side frames or arms, E, attached to the axis or shaft, F, which works in the bearings, G. An armature, H, is fixed between the ends of the arms, E, placed immediately above the magnets. The electrotome, I, for forming the make-and-break-contact is fixed on the axis, F; this electrotome is in communication through the spring, K, with one of the poles of a suitable voltaic or other battery, placed by preference below the table inside of the main frame, A, the other pole of which being connected to one end of both the conduc-

tors or coils arouud the magnets, the other ends of the conductors are joined separately, one to each of the springs, L and L'. These springs are insulated from each other by the uon-conductiug-bracket, M, upon which they are fixed. N, are two cylindrical cases enclosing spiral or other suitable springs, each being fixed, as showu, to one end of the frame, A, and at the other end to the studs, O, which project from the short ends of the arms, E, and act as a counterbalance to the platen. The operation of tbe press is as follows. Two forms of type are first placed on the bed of the frame, one on each side of the axis, F, and connection is made with the battery in the manner before described. One of the type-forms is then inked, and a sheet of paper having been placed on the platen, the small handle, P, is turned, by which the spring, K, is released from contact with the electrotome, I, thus breaking the electric circuit. The platen is then turned over upon the type-form at the other end of the frame, and in so doing the tongue, *a*, of the electrotome forms contact with one of the springs, L, which brings its magnets into operation, the handle, P, having, in the meantime, been readjusted so as to establish a connection with the battery, and as the armature has been brought near to the poles of this magnet, it is within this limited space suddenly and powerfully attracted, drawing down with it the platen, whereby the paper receives an impression from the type. Another sheet of paper having been placed on the upper face of the platen, and the other type-form inked, the electric circuit is broken by moving the handle, P, as before, and the platen being turned over again brings the tongue, *a*, of the electrotome into contact with the other spring, L, which directs the electric circuit arouud its magnet, and as it draws down the armature another impression is obtained. In this manner the work is simply and rapidly performed, and with very slight exertion of manual labour.

The specification includes another modification of printing press, in which magnets are placed at each of the four corners of the frame and bed on which the forms of type are placed, armatures being also fixed at each corner of the platens. These platens are connected together and held in their true position by guide-rods, and balanced by counter weights and chains hung over pulleys. As in the modification first described there is a handle by means of which the electric circuit may be broken as required. The operation of this form of press is very simple. By drawing down one of the platens, the electro magnets, acting on its armatures, are thrown into operation by a suitable electrotome, the construction of which, it is not necessary further to describe. Whilst one platen is in action the type-form under the other is being inked as before.

The specification also describes an arraugement for bringing the inking-rollers in contact with the printing surface of a cylindrical press. Near the surface of the cylinder on which the forms of type or blocks are attached are arranged a set of inking and diffusing rollers, the inking-rollers being carried on the end of a lever, to the other end of which an armature is fixed, arranged with electro-magnets, which operate on the armatures, and thereby bring the inking-rollers in contact with the priuting surface at desired periods, regulated by electrodes fixed on the axis of the cylinder, which, by suitable connections, complete the circuit of the current around the magnets. A separate and distinct electrotome is employed to each set of rollers, and on the periphery of each as many divisions or projections are made as there are printing forms to each colour. In this way, it will be readily seen, any number of colours may be printed at every revolution of the cylinder.

The specification also describes a simple machine, worked out in accordance with these improvements, for stamping, beating, embossing, and perforating purposes generally. The working block or hammer of this embossing or perforating machine, as the case may be, is fixed to a lever working on an axis, and having attached to its other end armatures. These armatures are drawn towards electro-magnets, on proper connection being made with a suitable battery, attached to the machine, which brings the hammer on the other end of the lever with great force against the surface of the embossing die or matrix, and as soon as the armatures arrive close to the poles of the magnets, the electric current is broken by the electrotome, and springs then draw back the lever, by which motion the circuit of the current is again completed, and another stroke of the machine is given and continued with great rapidity.

LAW REPORTS.

YOUNG *v.* FERNIE. Before Vice-Chancellor Sir J. Stuart. Nov. 14.

This was a motion on behalf of the plaintiffs, the owners of the paraffin oil patent, asking for an injunction to restrain the defendant, who is the proprietor of certain oil works at Leeswood and Saltney, in the county of Flint, from manufacturing or selling any paraffin oil, or paraffin, made in violation of the letters patent granted in 1850, to Mr James Young, and now vested in the plaintiffs. The patent has been the subject of much previous litigation, and an action, which resulted in a verdict for the plaintiffs, was tried in Scotland in 1860, (see *Practical Mechanic's Journal*, vol. V., New Series, page 240) The case is of interest as illustrating the course of practice which will probably, for the future, be followed in patent causes, now that the legislature has deprived the Court of Chancery of the power of sending questions of law and fact to be tried by Courts of Common Law, and required it to adjudicate alone upon these points as they arise.

The Act to which we refer came into force on the first day of Michaelmas term, and the present was the first case in which the Court has been called to consider its operation. It will be remembered that the common practice in these cases (whether the Court did or did not grant an injunction,) was to direct the plaintiff to bring an action to try the validity of the patent, retaining the bill in the meanwhile, so that the result of the suit in equity would depend on the result of the action. The power of the Court thus to direct an action is now abolished by the Act 25 and 26 Vic., c. 42, unless in a few exceptional cases, and the Court will be bound itself to determine the validity of patents brought under its consideration in suits to restrain infringements. In the present instance, shortly after the case of the plaintiff had been opened, the Vice-Chancellor stated that he thought it was desirable that the case should be brought on as a motion for decree, so as to enable the Court to decide completely and finally upon the issues raised.

To this the plaintiffs' counsel replied, that the amount of evidence necessary to bring the case before the court in such a form as to enable it to make a final decision, was so large that it would be impossible to get it together except after a considerable lapse of time; and they submitted that the patent being now twelve years old, and having been already the subject of litigation, the court, although it would not shut out the defendant from litigating the points of law if they had not been decided against him individually, would, nevertheless, for the purpose of the present interlocutory application, act on the evidence as it stood, and give to the age of the patent, and the litigation which had taken place, that credit which would enable an injunction to be granted until the hearing of the cause.

The VICE CHANCELLOR said the plaintiffs were asking him to apply the old system of proceeding to a new state of things, to which it seemed *primâ facie* inapplicable; because the purpose of the legislature was that whenever the jurisdiction of the court fastened on a thing of this kind, the judge should see it out. When the practice was to send the question of law to another court, it was, of course, necessary that the motion should stand over, but the court had now power to summon a jury and try the question, and he thought it would be very inconvenient to have the case heard on imperfect evidence now, and then to have the matter reheard at a future time on further evidence. He was not disposed to restrain the defendant for a while, and then put it upon him to come at a future time to have the injunction dissolved.

After some further discussion it was arranged that the motion should stand over to the hearing of the cause, the defendant undertaking, in the meanwhile, to keep an account of the oil manufactured by him, in alleged violation of the patent.

Sir Hugh Cairns, Mr E. K. Karslake, and Mr W. N. Lawson, instructed by Mr John Henry Johnson, were counsel for the plaintiffs. The Solicitor-General (Sir Roundell Palmer), Mr Mackeson, and Mr Chance, instructed by Messrs Tuke and Valpy, represented the defendant.

THRASHING MACHINES.—Prolongation—Goucher's Patent, Nov. 15, 1862. This was an application to the Judicial Committee of the Privy Council, before the Right Honourable Lord Chelmsford, and Lords Justices Knight Bruce, and Turner, for the prolongation of Letters Patent, dated 25th November, 1848, to Mr John Goucher, for an invention of "a Machine for Thrashing corn and other grain."

Mr Goucher was examined at great length in support of his petition for a prolongation of the original term of his patent, and stated his invention to consist of an improved form of Beater for Thrasbing Machines; the ordinary beater consists of several longitudinal bars attached to arms or spokes, or to the periphery of wheels affixed to a central shaft or axis with which the beater revolves. Mr Goucher alleged that this form of beater, on the introduction of Steam Thrashing Machines, was found to crush and bruise the corn; his invention, intended to obviate this objection, consists in making these beaters or bars with grooves or channels on their surface, by which both the straw and grain are preserved from being broken.

The specification describes two forms of beater, one of which, as in fig. 1, consists in forming the bars with grooves or channels on their beating surface: the other plan, as in fig. 2, simply consists in winding iron round the edges of plain bars.

It appeared from the evidence that Mr Goucher was not able to introduce the new beaters for a considerable time after the date of the patent, and one reason for this was stated to be the great difficulty he met with in procuring bars of such a nature as to stand the wear they are subject to. The patentee had granted a mortgage of his patent to his solicitor, and a peculiar feature in the case consisted in the fact that

the mortgagee was not only no party to the application for the extension, but no account of his receipts and payments was produced, although they are admitted to have been considerable.

Fig. 1.

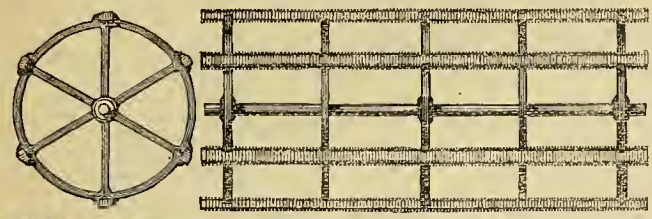


Fig. 2.

It appeared that the patentee had altogether received a royalty of £1 per beater, on about 5000 beaters, but he alleged that (principally in consequence of his experiments upon iron intended for his beaters) he had lost about £2000, by the patent.

Lord Justice Knight Bruce, stated that their Lordships were of opinion that the invention was one of considerable merit, and although not satisfied with the accounts, they should recommend Her Majesty to grant a prolongation of the patent for three years.

The accounts, including the accounts of the mortgagee, to be laid before the Attorney General, who would determine whether they had been fairly made out, and what were the fair results of profit and loss by the invention. Their Lordships had further agreed that if the Attorney General should be of opinion the invention had produced a clear profit of £2000, that no prolongation should be granted, and also, that in case of a new term the mortgagee and inspector should remain in the same position, with respect to it as to the present one.

Mr Grove, Q.C., instructed by Messrs Pritchard and Collette, for the petitioner; and Mr Webster, instructed by Messrs Tweed and Hughes, of Lincoln, and Mr J. Henry Johnson, of Lincoln's Inn Fields, appeared to oppose, on behalf of Messrs Clayton and Shuttleworth, of Lincoln, but the opposers were not allowed to be heard, in consequence of their notice of objections being lodged five days after the time limited by the advertisements for the entry of caveats.

The Attorney General was present in behalf of the Crown.

AMERICAN PATENT LAW.

Silverthorn's Assignees *v.* Mitchell: Undue Delay in Applying for a Patent.

This is a case which is of some interest at the present time, when it is proposed to take the American law of patents as a model for certain alterations which are thought desirable in the patent law of this country. We allude to the proposition which has been made, that before a patent is granted, an examination of the claims of the alleged inventor shall be instituted before a duly constituted court, and that such examination shall be of a much more searching character than that now made by the Attorney or Solicitor-General.

By the American law, an intending patentee sends in his claim to a commissioner of patents, who carefully examines it, and if he finds that it comes in conflict with other similar applications, or with any unexpired patents, gives notice thereof to the parties affected thereby, and declares what is termed, "an interference."

Upon this a hearing takes place before the commissioner, who decides between the contending parties, and issues or refuses the patent accordingly, his decision being subject to an appeal to the chief justice of the district court of the United States for the district of Columbia.

Another point necessary to be borne in mind in perusing the following case is that if a patentee finds that his patent embraces claims which he cannot substantiate, he is at liberty to surrender it, and apply for its re-issue in amended form, in which the claim which has been found too extensive shall be omitted. This process is analogous to our system of disclaimers; but there is this important difference between the American law and our own, that whereas, by the latter, the Attorney-General merely decides on the right to enter the disclaimer, leaving the validity of the patent, so altered, to be determined in the ordinary manner by litigation in the courts; by the former, the whole subject of the right of the patentee to his patent is re-opened on the application for re-issue, and the commissioner has power to refuse such re-issue altogether.

The facts of the present case are as follows:—In August, 1857, one Silverthorn applied for a patent for an invention of a shoe tip of *whatever material made.*

In December, 1856, one Mitchell filed an application for a metal tip.

An interference was declared, and the commissioner decided in favour of Mitchell, November, 1857. In December, 1857, Silverthorn withdrew his application, upon condition that such withdrawal should not debar him at any future time from testing the validity of the patent granted to Mitchell.

In 1858, Mitchell surrendered his patent, and obtained a re-issue thereof, the claims being—1st, a metallic tip; 2d, a metallic tipped boot or shoe.

In July, 1859, Silverthorn's assignees filed an application for a shoe tip of *india rubber*, and obtained letters patent in November of the same year.

In December, 1860, Mitchell surrendered his re-issued patent, and applied for a re-issue, as for a claim of a shoe tip of *any* material.

In February, 1860, Silverthorn's assignees surrendered their patent, and applied for a re-issue, upon the broad claim of a shoe tip of any material. This claim was therefore in direct conflict with Mitchell's claim for a second re-issue, and an interference being declared, the case was heard before the commissioner of patents, who decided in favour of Mitchell. From this decision, Silverthorn's assignees appealed, and the matter was heard before Chief Justice Dunlop.

It appeared in evidence that Mitchell invented his shoe tip in 1852, but had omitted to apply for a patent. It was therefore contended that he had lost his right by laches, as he was bound by the rules of American law to have applied for his patent within two years from the time when he had perfected his invention.

The counsel for Mitchell urged in reply to this, that until machinery was contrived for the purpose of making the patented article, Mitchell could not expect to make the business profitable; and that to take out a patent before sufficient quantities of the article had been manufactured, so as to enable the invention to be introduced at once to public use, would waste much of the term of the patent.

The Chief Justice delivered judgment in Aug., 1862; and, referring to the above stated argument, said that the matters there urged might be good reasons for an extension of a patent, but none for delay in applying for it. He cited various cases to show that an inventor who designedly, and with the view of applying his invention exclusively for his own profit, withholds his invention from the public, does not come within the policy of the patent law of the United States, and, after referring to some other objections, which were of a technical character, he gave judgment in favour of the re-issue to Silverthorn's assignees.

REVIEWS OF NEW BOOKS.

ENGINEERING HAND BOOKS.

Mathematics for Practical Men, for the Use of Engineers, &c. By Dr Olinthus Gregory; enlarged by H. Law; and edited by J. R. Young. Fourth edition. London: Lockwood & Co. 1862. 1 vol., 8vo.

More than a third of a century has passed away since Dr Gregory, of the Royal Military Academy, Woolwich, produced the volume which forms the substratum still upon which three subsequent editions have been overlaid.

The original, was not remarkable either for lucidity of expression and arrangement, or for accuracy. In the latter respect, its enlarger, Mr Law, does not appear to have improved it, for Mr Young, known as a competent mathematician, from his former connection with Belfast College and various educational works, confesses in his short preface, to having had to correct more numerous errors, in the formulæ, with which the work abounds, than he had at all expected to have found in it.

That the work now, is better than when it left its author's hands originally, and that it does now contain (as every such work inevitably must) a vast deal of useful matter, we do not deny; but it is not the sort of book demanded in the year 1862, by the class for whom it is intended. Besides labouring under that enormous difficulty that must always exist in fitting in and adapting new matter, after a lapse of a third of a century, into an old book,—a process which, like patching new cloth upon an old garment, makes the incongruity worse than before, —this work continues and even extends, the original absence of any clear conception on the part of the author, of the difference between information for education, and information for direct use; mixing both within even the somewhat ponderous compass of the present edition, double in bulk of the original, renders each incomplete and inadequate.

This might, with the stringent use of the shears by the editor, have been made less objectionable, by omitting a number of subjects that Dr Gregory inserted, either because he happened to be familiar with them in relation to the Woolwich Academy, or otherwise, or as having, in 1825, a temporary interest which they have now lost. For example, the whole of chapter xii., appendix, *on the principles of Chronometers*, and of the succeeding ones to the end, might have been well omitted.

Of what *general* value now are the observations on the effect of old London Bridge on the tides, &c.; or what is the need of resuscitating Professor Farish's first notices on isometrical perspective, now that far better special treatises exist upon the subject, which are familiar to almost every draughtsman and clerk? This process of excision might have been advisedly extended to the body of the work, also, *e. gr.*, the greater part of chapters vi. and vii., which epitomise some of Dr Gregory's lectures, on conic sections and the properties of curves, delivered to the Cadets of Woolwich, and which were doubtless very wholesome exercises to these young men of *that day;* are scarcely so, in an educational sense now, to any one, and to engineers almost as useless as a treatise on valuing annuities, or any other equally foreign to his daily needs.

We do not observe that in either part I. or part II., the work has been much freed from its original sins of omission or commission, nor its arrangement altered or improved. We still have, in section 11, part I., logarithmic arithmetic commenced at page 41, and various rules gone through, without an attempt at a definition of *what is* a logarithm, or, indeed, any fundamental information on the subject whatever, until at the end of Algebra, at page 95, we have it, for the first time, given, and then not over clearly or well. This applies to the book in its *educational* aspect. For such a book as this we should expect at least to find that in its *informational* one, it would be up to the mark. In the most rudimentary particulars, however, we find here some most surprising omissions. For example, no work now-a-days, that professes to teach arithmetic, and yet omits all notice of the *German chain rule*, the most important and facile instrument for working questions of proportion ever derived, can be viewed as other than most imperfect.* Again, so common-place a subject as mensuration, we might hope to find clearly, briefly, and fully given; yet, to only name one serious omission, no formula for the area of a circular annulus is given, and not even an allusion made to the theory of Guldinns, which in the "Barocentric method" affords the very simplest modes of obtaining the solidities of irregular solids of revolution, &c. Again, in what is said as to measuring heights and distances, the barometer is referred to, with a formula or two; but all that has been done in later years with this and the aneroid, as hypsometric instruments, and the improvements and simplifications that have been made in formulæ and tables, applicable to these either for approximate or for exact use, are left without a word.

These, and a good many other such defects, we might have expected Mr Young to have remedied. He is probably, however, but little responsible for retaining a vast deal of nearly useless, though very *learned-looking*, matter that was wedged into the volume by Mr Webb, a great deal of which is now totally behind the time. De Pambour's treatise on the steam engine, highly valuable as it was once, and large as was the advance it made when published, does not now represent the theory of the steam engine, as based on thermo-dynamics. So all that is said about water wheels is equally in the rear of knowledge, indeed some portions positively wrong. As to the turbine, its treatment rests as Dr Gregory left it, at *Barkers' mill!*

For anything that appears in the chapters on statics, as applied, the editors might be supposed wholly ignorant of what has been done of late years by Neville, Rankine, and others, on the subject of the pressure of earth on revetments, &c. It is needless, however, to pursue the ungrateful task of pointing out further defects. The reproduction of the book at all, has been a mistake. Books, like men, however vigorous in their prime—and this particular book never had a well ordered constitution—grow old at last. It is best, then, that they should be let to die in peace, and that their memories, with those of their authors, should be embalmed in the remembrances of the greater or less advance of human knowledge that they effected. Science is ever hasting on; and, except in the case of the works, of one or two of the gods amongst men, the attempt to keep them alive by the transfusion of younger blood only ends in making a wooden Frankenstein monster. This work, which is beautifully printed, contains several large tables of logarithms, factors, elements of circles, specific gravities, &c, and a comparatively useless one of lengths and vibrations of pendulums.

Our view, however, is, that tables of these sorts, are best printed separately as volumes of tables; books of elementary education separately as such; and hand-books of cut and dry technical information separately from both, and in the briefest and most readily accessible form.—Ed.

The Engineers', Millwrights', and Machinists' Practical Assistant. By William Templeton. Second Edition. Lockwood & Co., London.

Few handbooks of mechanical data have had so wide a circulation as this unpretending little volume in its first edition. It owed its popularity to its simplicity and extremely rudimentary character; it first hit, in fact, to a certain extent, the wants of the very imperfect education of our artizans, and stood alone in doing so in a sufficiently elementary way, and what information it did give, was pretty accurate.

In the preface to this second edition, the author says he found with astonishment, on returning after an absence of more than ten years from England, that his own compilations, published more than thirty years ago, were works still called for, so he determined upon this new issue. This edition improves the former in several points. We cannot help thinking, however, that it is a mistake to endeavour to unite in one work elementary, *very* elementary *instruction*, such as should form a part of all common school education, decimal arithmetic, for example, with cut and dry *information*, technical data, which form the legitimate subject of every *aide memoire*.—Ed.

A Treatise on the Marine Boilers of the United States. By B. H. Bastol, Engineer. 1 vol. 8vo. Philadelphia. London, Trübner.

This is by no means a new work, but it is, we apprehend, to a great extent new to British engineers. It contains the particulars of the vessels, engines, and performance, all partially; and of the boilers, very fully, of between sixty and seventy of the best steamships of the United States. Boilers of almost every form, from the long plain or flued cylinders placed on deck, to flued and tubular boilers put below. Of almost the whole of these, outline drawings (in woodcuts) are given, and the main elements, as to boiler and grate surface, rate of consumption, &c., &c., and sort of fuel, by which their performance, as instrumeuts for producing steam, can be compared.

The boilers are all drawn to a scale of 3 16th-inch to the foot, and in almost all cases the water evaporated by 1 lb. of fuel is given. But from all this mass of data, which cannot be pronounced other than valuable, almost no deductions are drawn. In *a single page*, at the end, the compiler discusses, not the facts which he has collected and so carefully produced—classifying, collating, colligating, and drawing conclusions from them—but the question, Which is the best boiler? and as may be supposed, in the absence of such careful use of his facts, arrives at no conclusion more precise than in the following words:—"I am of opinion that *equal* efficiency may be obtained by *either of the forms* of boilers here shown, if properly constructed"—"for sea-going steamers that boiler is best which, giving equal effect, occupies least space, keeping in view facilities for cleaning and repair"—a conclusion to be received with much dubitation. He recommends narrowing the American furnaces, and increasing their number and lengthening the divisions between, towards the funnel.

The data here given admit of far more precise and extended deductions, and that these would not be profitless in practical suggestion is indicated by the fact, that the water evaporated per pound of coal, as given, varies in different boilers in the ratio of more than 2 to 1.

We recommend this book to the attention of some of our readers of the student class. In the hands of a competent man, with a little leisure to devote to the full discussion of the facts given, the essence of this (as it now stands) nearly useless book, might be made to contribute some useful additions to our practical experience as to the construction of marine boilers.—Ed.

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* As regards the German chain rule, we may refer, for excellent expositions of it, to Galbraith and Haughton's Manual of Arithmetic, or to Schönberg's Chain Rule, a little pamphlet published by Effingham Wilson, London.—Ed.

MECHANIC'S LIBRARY.

Agricultural Tour in Belgium and the Rhine. Post 8vo, 7s, cloth. Burn.
Air and Water—Their Impurities and Purification. 8vo, 3s 6d. Condy.
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Vine, Practical Treatise on the Culture of. Third Edition. 8vo, 5s, cloth. Phipson.
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CORRESPONDENCE.

☞ We do not hold onrselves responsible for the views or statements of our Correspondents.

PHOTOZINCOGRAPHY.

The following communication, announcing a probably highly important result now within view, has been addressed by Sir Henry James to the *Times*:—

Sir,—I shall be glad to announce that we have accidentally made the discovery, that the paper prepared with the bi-chromate of potash and gum only, as described in the work on Photozincography lately published by Messrs Longman and Co., will, if only kept for a week or ten days in the dark, yield half tones, and consequently give us lithographic or zincographic prints from any photograph.

I enclose two copies of a print produced in this manner, which, although not so perfect as we can undoubtedly make them, will prove that the object so long sought after has now been attained.—I am, Sir, your obedient servant,

Henry James,
Colonel Royal Engineers.

Ordnance Survey-office, Southampton, November, 1862.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION.

Section A.—Mathematical and Physical Science.

October 2.

"Suggestions on Balloon Navigation," by Isaac Ashe, M.B.—The author proposed a simple contrivance by means of which the opening of the escape valve should depend, when desirable, on the relaxation of voluntary exertion on the part of the aëronaut, so that, in the event of insensibility supervening at great altitudes, the valve should open spontaneously by means of a weight attached to its rope, thus causing a descent of the balloon to safer altitudes, and obviating the danger to life incurred by Messrs Glaisher and Coxwell, during their recent scientific ascent from Wolverhampton, in consequence of their becoming insensible.

"Extract from an Account of a Visit to the Kew Observatory, presented to the Portuguese Government," by Prof. J. A. De Souza, Professor in the University of Coimbra.

"On some Peculiar Features in the Structure of the Sun's Surface," by Mr J. Nasmyth.—Mr Nasmyth gave a short but interesting sketch of the character of the sun's surface as at present known. He described the spots as gaps or holes, more or less extensive, in the luminous surface or photosphere of the sun. These exposed the totally dark bottom or nucleus of the sun; over this appears the mist surface—a thin, gauze-like veil spread over it. Then came the penumbral stratum, and, over all, the luminous stratum, which he had had the good fortune to discover was composed of a multitude of very elongated, lenticular-shaped, or, to use a familiar illustration, willow-leaf-shaped masses, crowded over the photosphere, and crossing one another in every possible direction. The author had prepared and exhibited a diagram, pasting such elongated slips of white paper over a sheet of black card, crossing one another in every possible direction in such multitudes as to hide the dark nucleus everywhere, except at the spots. These elongated lens-shaped objects he found to be in constant motion relatively to one another; they sometimes approached, sometimes receded, and sometimes they assumed a new angular position, by one end either maintaining a fixed distance on approaching its neighbour, while at the other end they retired from each other. These objects, some of which were as large in superficial area as all Europe, and some even as the surface of the whole earth, were found to shoot in thin streams across the spots, bridging them over in well-defined streams or comparative lines, as exhibited on the diagram; sometimes by crowding in on the edges of the spot they closed it in, and frequently, at length, thus obliterated it. These objects were of various dimensions, but in length they generally were from ninety to one hundred times as long as their breadth at the middle or widest part.

The Rev. Dr Pritchard gave a sketch of the construction and effect of the reflecting part of glass as suggested by Sir John Herschell. Its most important office was that it sent off from the eye of the observer 98 per cent. of the sun's heat, which before was so intense as frequently to break the obscured glass, by which his eye had been protected, so suddenly as to endanger loss of sight. Now the observer was placed in the most absolute security, and could at pleasure moderate the light reflected to the eye-piece; inasmuch that he assured the section that, with a very moderate teleseope, whose object-glass was not more than three or four inches aperture, the willow-leaved objects of which the sun's luminous surface seemed entirely composed, and which had been first discovered by Mr Nasmyth, and the discovery of which he had looked on as a most important epoch in the study of the physical constitution of the sun, could be seen distinctly and studied at leisure. The whole difficulty lay in first seeing them: as soon as that was once got over, he assured the members of the section that none of them would feel the slightest difficulty in seeing and studying them and their relative motions. Some of the most extraordinary objects had a surface larger than that of the entire earth.

"On the Extent of the Earth's Atmosphere," by Professor Challis.

"On the Augmentation of the Apparent Diameter of a Body by its Atmospheric Refraction," by the Rev. Professor Challis.

"On the Hindú Method of Calculating Eclipses," by Mr W. Spottiswoode.

"Description of an Optical Instrument which indicates the Relative Change of Position of Two Objects (such as Ships at Sea during Night) which are maintaining Independent Courses," by Mr J. M. Menzies.—This instrument consisted of a lantern-shaped case, containing a lens or eye in front and a concentric sheet of bent glass behind, at the focal distance of the lens ruled with parallel vertical lines. This was hung up so as to have its axis parallel to the course of the vessel, and the bright spot the image of the lights of the approaching vessel showed by its position and shifting the relative place and course of the approaching vessel.

"On British Rainfall during 1860-1861," by Mr G. J. Symons.

"On the Performance, under trying circumstances, of a very small Aneroid Barometer," by Mr G. J. Symons.

"Observations on Three of the Minor Planets in 1860," by Mr Norman Pogson; communicated by Dr Lee.

"On the Mechanical Power of Electro-Magnetism, with special reference to Dr Joule and Dr Scoresby's Theory," by Dr J. Croll.

October 3.

"Provisional Report on a Proposed Standard of Electrical Resistance," by Mr Fleming Jenkin.

"Provisional Report on Thermo-electric Currents in Circuits of one Metal," by Mr F. Jenkin.—Mr Jenkin first gave a short description of the electrical currents to which he had drawn the attention of the Association at their previous meeting, as due to loose contacts between two unequally heated wires of one metal. Experiments were then described with loose contacts between wires of two dissimilar metals. The great intensity of the currents so obtained, compared with the ordinary thermo-electric currents from metallic contact between the two metals, was pointed out; and it was shown that an analysis of the results proved, beyond doubt, that the currents were of the same nature as those produced by unequally-heated metals placed in an electrolyte: the thin films of melted oxides of copper and iron constitute this electrolyte with unequally-heated junctions at surface of the two wires. This theory requires that the oxide of copper should be considered far more positive than iron, and the oxide of iron far more negative than copper. Direct experiments with oxides of iron and copper between platinum wires confirmed this conclusion. It was, however, still considered doubtful how far electrolytes could be included in a true thermo-electric scale. It was stated that Sangoni had, in 1853, anticipated some of these results. A suggestion was then made that the current observed by Magnus and others at the first metalic contact of unequally-heated wires of one metal may be due to the fact that the electrical qualities of a perfectly homogeneous metal does not depend solely on its temper and temperature, as has been hitherto supposed, but to some extent on the time during which it has been maintained at that temperature; a fact proved, as regards electrical resistance, by Mr Mathieson. In support of this view, it was stated that the currents obtained from these metallic contacts are not instantaneous, as generally supposed, but continue for, at least, five minutes after contact has been made, gradually diminishing from a maximum to zero.

"Report on Certain Dynamical Problems," by Mr A. Cayley.

"On a Certain Curve of the Fourth Order," by Mr A. Cayley.

"On the Representation of a Curve in Space by means of a Cone and Monoid Surface," by Mr A. Cayley.

"On a Certain Class of Linear Differential Equations," by the Rev. R. Harley.

"Some Account of Recent Discoveries made in the Calculus of Symbols," by Mr W. H. L Russell.

"On Meteorology," by Mr T. L. Plant.

"On a Instrument for describing Geometrical Curves, invented by Mr H. Johnston," described and exhibited by the Rev. Dr Booth.—This instrument supplies a want which has been felt by architects and sculptors. By its help, geometrical spirals of various orders may be described with as much manual facility as a circle may be drawn on paper by a common compass.

"On Three New Craters in the Moon, not delineated in Beer and Mädler's Map," by Mr G. R. Birtt.

"On the Dimensions and Ellipticity of Mars," by the Rev. R. Main.

"Light and Shooting Stars," by Professor Challis.

"On Autographs of the Sun," by Professor Selwyn.

October 4.

"Report of a Committee to inquire into the Adequacy of existing Data for carrying into effect the Suggestions of Gauss, to apply his General Theory to Magnetic Variations," by the Rev. Dr H. Lloyd.

Mr F. J. Evans read a Report, by Mr A. Smith and himself conjointly, "On the Three Reports of the Liverpool Compass Committee, and other recent publications on the same subject,"—undertaken at the request of the British Association. The papers included were, severally, by the Astronomer Royal, the late Dr Scoresby, and Capt. Johnson, R.N., on the deviation of the compass and the magnetism of iron ships; as also contributions in the same field of inquiry by the reporters. After a general review of the formulæ employed and

recommended, the report states that the first and most important general result which is derived from all the observations recorded in these works, and from many more which have not been published, is that the observed deviations of the compass are represented by the formulæ derived from Poisson's theory with a correctness which is within the limits of error of observation. After bearing testimony to the practical and scientific knowledge brought to the subject by the Secretary (Mr Rundell) of the Liverpool Compass Committee, and the amount of industry and zeal which have given to the three reports published the highest possible value, it is considered that the results of their extended and varied observations lead to definite conclusions which may nearly, to the full extent, be accepted as being now established. Among these are—1. That the magnetism of iron ships is distributed according to precise and well-determined laws; 2. That a definite magnetic character is impressed in every iron ship while on the building slip, which is never afterwards entirely lost; 3. That a considerable reduction takes place in the magnetism of an iron ship on first changing her position after launching, but afterwards that any permanent change in its direction or amount is a slow and gradual process; 4. That the original magnetism of an iron ship is constantly subject to small fluctuations from change of position, arising from new magnetic inductions; 5. That the compass errors occasioned by the more permanent part of a ship's magnetism may be successfully compensated; and that this compensation equalises the directive power of the compass needle on the several courses on which a ship may be placed. On the effect of heeling, a considerable body of evidence is collected: the most important practical result, as to the amount of the heeling error, is the great amount to which it reaches in certain ships and in certain positions in the ship, several examples of even two degrees of change for one degree of heel being recorded. The report points to certain desiderata:—1. That in the construction of iron vessels, regard should be had to the providing a proper place for the compass; the present difficulty being to reconcile this with the requirements of construction and of working the vessel; 2. That for throwing light on the points which are still obscure, the complete magnetic history of some iron vessels in various latitudes should be known: this might be accomplished by observations of durations, and horizontal and vertical force, made at various fixed positions, in some new iron vessel, in an extended voyage in both hemispheres, and in which the magnetical observations would be made an object of importance.

The Astronomer Royal wished to say that as regarded the two ships alluded to in the report whose magnetism it had been stated he had investigated, at that time absolutely nothing was known of the distinction so necessary to be attended to between permanent magnetism and the magnetism induced both by the change of position of the ship and the action of the sea upon her; and the plates furnished to him for examination were found to be so various in the permanent magnetism they had acquired from the various processes, as rolling, cutting, punching, &c., through which they had passed, that he had been led to suppose that this must, in the ship, mark every other cause of magnetic change.

"Report on Double Refraction," by Professor Stokes.

"Relation entre les Phénomènes de la Polarization Rotatoire, et les Formes Hémièdres ou Hémimorphes des Cristaux à un ou à deux Axes Optiques," by M. A. Des Cloizeaux.

"On some of the Characteristic Differences between the Configuration of the Surfaces of the Earth and Moon," by Professor Henessey.

"On an Experimental Determination of the Absolute Quantity of Electric Charge on Condensers," by Dr Esselbach.

"On some Improvements in the Barometer," by Mr Isaac Ashe.

"On the Determination of Heights by means of the Barometer," by Mr J. Ball.

"On the Volumes of Pedal Surfaces," by Mr T. A. Hirst.

"On the Eccentricity (or, as the author preferred it should be termed, the Eccentrality) of the Earth, and the Method of finding the Co-ordinates of its Centre of Gravity," by Mr W. Ogilby.

October 6.

"Report on Luminous Meteors," by Mr J. Glaisher.

"On a new Barometer used in the last Balloon Ascents," by Mr J. Glaisher.—Mr Glaisher exhibited a mercurial barometer which had been designed and constructed by Messrs Negretti and Zambra, for the purpose of checking the readings of the Gay-Lussac's barometer, which had been used in the several late balloon ascents. The correctness of the readings of a Gay-Lussac's barometer at low pressure depended upon the evenness of the tube, and it is difficult to colligate so large a tube. Messrs Negretti and Zambra selected a good tube, 6 feet in length, attaching a cistern to its lower end. Mercury was boiled throughout the length of the tube; at the entrance of the cistern was placed a stopcock, by which means any definite quanity of mercury could be allowed to pass from the upper half of the tube into the cistern, and its height in the cistern noted and engraved; then a second portion, and so on. This process could be repeated. When the cistern was thus satisfactorily divided, the tube was cut in two, and to the upper half the cistern was joined; a scale was attached to this portion, and the reverse operation was performed,—viz., allowing portions of the mercury to pass from the cistern into the tube, which could be regulated by means of the stopcock, and thus the scale was divided. The process, in fact, is using the tube to graduate itself. In carriage, the stopcock locks the mercury in the tube. This instrument was used, and acted well on the extreme high ascent.

"Report on Vertical Movements of the Atmosphere," by Professor Henessey.

"On the General Solution of the Linear Equation in Finite Differences," by Professor Sylvester.

"On the Differential Equations of Dynamics," by Professor Boole.

"On the Measurement of the Temperature of Active Volcanic Foci to considerable Depths, and of the Temperature and Issuing Velocity of the Steam and Vapours evolved," by Mr R. Mallet.

"On the Relative Amount of Sunshine falling on the Torrid Zone of the Earth," by Professor Henessey.

"On the Form and Motion of Waves at and near the Surface of Deep Waters," by Professor Rankine.

"On the Additional Evidence of the Indirect Influence of the Moon over the Temperature of the Air, resulting from the Tabulation of Observations taken at Greenwich, 1861-62," by Mr J. P. Harrison.

"On the Distribution of Fog round the Coasts of the British Islands," by Dr Gladstone.

"On the Hurricane near Newark of May 7, 1862, showing the Force of the Hailstones and the Violence of the Gale," by Mr E. J. Lowe.

"European Weather Charts for December, 1861," by Mr F. Galton.

"On the 'Boussole Burnier,' a new French Pocket Instrument for measuring Vertical and Horizontal Angles," by Mr F. Galton.

"On Objections to the Cyclone Theory of Storms," by Mr S. A. Rowell.

"Meteorological Observations registered at Huggate, Yorkshire," by the Rev. T. Rankine.

"On the Means of following the Small Divisions of the Scale regulating the Distances and Enlargement in the Solar Camera," by Mr A. Claudet.

October 7.

"On Eight Scientific Balloon Ascents," by Mr Glaisher.—The author said, the primary objects of the experiments were—the determination of the temperature of the air and its hygrometric state at different elevations, up to five miles. The secondary objects were—to compare the readings of an aneroid barometer with those of a mercurial barometer up to 5 miles; to determine the electrical state of the atmosphere; to determine the oxygenic condition of the atmosphere by means of ozone papers; to determine the time of vibration of a magnet on the earth and at different distances from it; to determine the temperature of the dew-point by Daniell's dew-point hygrometer and Regnault's condensing hygrometer, and by the use of the dry and wet bulb thermometers as ordinarily used, and by their use when under the influence of the aspirator, so that considerable volumes of air were made to pass over both bulbs at different elevations, as high as possible, but particularly up to those heights where man may be resident, or where troops may be located, as in the high lands and plains of India, with the view of ascertaining what confidence may be placed in the use of the dry and wet bulb thermometers at those elevations by comparison with those found directly by Daniell's and Regnault's hygrometers, and also to compare the results as found by the two hygrometers together: to collect air at different elevations; to note the height and kind of clouds, their density and thickness at different elevations; to determine the rate and direction of different currents in the atmosphere, if possible; to make observation on sound; to note atmospherical phenomena in general, and to make general observations. The instruments used consisted of mercurial and aneroid barometers; dry and wet bulb thermometers, also, an exceedingly sensitive thermometer; Daniell's dew-point hygrometer; Regnault's condensing hygrometer; solar radiation thermometer; maximum and minimum thermometers; a small magnet for horizontal vibrations, hermetically sealed, and exhausted glass tubes; ozone test papers, &c. In the ascent on July 17, a height of 26,177 feet was reached; and in the descent a mass of vapour of 8000 feet in thickness was passed through, so dense that the balloon was not visible from the car. In that of August 18 an altitude of 11,500 feet was attained; then the balloon descended to 3,200 feet; then ascended to 23,400 feet, where a consultation took place, and it was decided not to go higher, as clouds of unknown thickness and moisture had to be passed through. In the ascent on August 20 the air was almost calm; the balloon for a long time hovered over the Crystal Palace, and then over London, whilst it was lighted up, where they seemed to be destined to remain all night; finally, went above the clouds, and came down at night near Hendon. The balloon was then anchored for the night, the lower valve being closed with the hope that the gas would be retained. Before sunrise, on August 21, all the instruments were replaced and the balloon left the earth; it was a warm, dull, cloudy morning; clouds were reached at the height of 5000 feet; the light rapidly increased, and gradually the balloon emerged from dense clouds into a basin surrounded with immense black mountains of cloud, rising far above; shortly afterwards there were deep ravines of grand proportions below, bounded with beautiful curved lines. The sky was blue with cirri. The tops of the mountain-like clouds became silvery and golden; at the height of 8000 feet we were on their level, and the sun appeared flooding with golden light all space for many degrees both right and light, tinting with orange and silver all the remaining space. It was a glorious sight. As the sun's rays fell on the balloon we rose more rapidly, each instant opening to us ravines of wonderful extent, and presenting elsewhere a mighty sea of cloud. Here there were shining masses in mountain chains, some rising perpendicularly from the plains, dark on one side, and silvery and bright on the other, with summits of dazzling whiteness; some there were of a pyramidal form, a large portion undulatory, and in the horizon Alpine ranges bounded the view. A height of nearly three miles was reached. On Sept. 1, when at the height of three-quarters of a mile over London, the whole course of the river Thames was visible from its mouth; and parallel to it, and bounded by its banks, a cloud or fog-bank extended the whole distance, following all its sinuosities. For half an hour before the descent, near Woking, in Surrey, the balloon was under one stratum of cloud and above another; the upper surface of the latter was remarked as bluish white, the middle portion the pure white of the cumulus, and the lower surface a blackish white, and

from which rain was falling on the earth. The balloon descended to a height of 1300 feet, but still above these clouds. It was afterwards learned that rain had been falling from these clouds all the afternoon. On Sept. 5, the balloon ascended from Wolverhampton: at 29,000 feet from the earth Mr Glaisher became insensible; the balloon still ascended to fully the height of 35,000 feet or 36,000 feet, and may have gone even higher. Mr Glaisher recovered his consciousness on descending, when at about the same height as he lost it on ascending. The author had prepared and exhibited diagrams showing the path of the balloon and temperatures of the air at different elevations for each ascent, and extensive tables of all his observations. The author spoke upon the electrical state of the air, which he found charged with positive electricity, decreasing in amount with elevation. With respect to ozone, he said none was shown in the earlier ascents, but that large quantities were shown in the latter, and attributed the deficiency in the former to bad paper. He remarked, that diminished pressure exercised a very different influence upon different individuals, dependent probably upon temperament and organisation; that the effect of high elevation was different upon the same individual at different times; that the time of vibration of a magnet was somewhat longer at high elevation than on the earth; that different notes and sounds pass more readily through the air than others, instancing that the barking of a dog can be heard two miles high, and the shouting of a multitude not one mile. I may also state that the too readily accepted theory as to the prevalence of a settled west or north-west wind was not confirmed in our trips; nor was the appearance of the upper surface of the clouds such as to establish the theory, that the clouds assume a counterpart of the earth's surface below, and rise or fall like hills and dales. The formation of vapour along the course, and during an ascent from the Crystal Palace, has already been alluded to: this was a very remarkable demonstration. The principal results deduced from these observations may be briefly stated. That the temperature of the air does not decrease uniformly with height above the earth's surface, and that, consequently, more elucidation upon this point is required, particularly in its influence on the laws of refraction. That an aneroid barometer can be made to read correctly, certainly to the first place, and probably to the second place of decimals, to a pressure so low as 5 inches. That the humidity of the atmosphere does decrease with the height, with a wonderfully increasing rate, till at heights exceeding 5 miles the amount of aqueous vapour in the atmosphere is very small indeed. That we now can answer the question I put in my opening remarks, and can say that observations up to 3 miles high, even of a delicate nature, can be made as comfortably in a balloon as on the earth; that at heights exceeding 4 miles they cannot be made quite so well, because of the personal distress of the observer; that at 5 miles high it requires the exertions of a strong will to make them at all. That up to 3 miles high any person may go into the car of a balloon who is possessed of an ordinary degree of self-possession. That no person with heart-disease or pulmonary complaints should attempt 4 miles high. But, at the same time, it must be borne in mind that I am concluding that the balloon is properly handled. It has been fortunate for this association and myself that we have had the assistance of Mr Coxwell, who has the experience of more than 400 ascents, based upon knowledge of natural philosophy, and that he knows "the why and because" of all his operations; and it was this fact, which I saw immediately from the clearness of his explanation to me for each operation, that enabled me to dismiss from my mind all thoughts of my position, and to concentrate my whole energies upon my duties. In conclusion, I feel certain that if these experiments prove that the balloon is available for philosophic research, then one of the brightest links in the long chain of useful works, performed through the agency of the association, will be the feeling that the balloon in proper hands may be made a powerful philosophic agent.

"Report of the Proceedings of the Balloon Committee," by Col. Sykes.

"On the Duration of Fluorescence," by Dr E. Esselbach.

"On Electric Cables with reference to Observations on the Malta-Alexandria Telegraph," by Dr E. Esselbach.

"On the Curvature of the Margins of Leaves with reference to their Growth," by Mr W. Esson.

"On the Disintegration of Stones exposed in Buildings and otherwise to Atmospheric Influence," by Professor J. Thomson.

"Report on Thermometric Observations in the Alps," by Mr J. Ball.

"On a Brilliant Elliptic Ring in the Planetary Nebulæ, R.A., 20° 36'. N.P.D. 101° 56',' communicated by Mr Lassell; by Dr Lee.

"Some Cosmogonical Speculations," by Mr I. Ashe.

"Account of an Electro-motive Engine," by Mr G. M. Guy.—The author explained the difficulty of obtaining, by any of the methods heretofore suggested, a sufficiently rapid motion within the small spaces through which magnets or electro-magnets acted with sufficient energy, and chiefly in consequence of the rapid diminution of that energy as the distance of the poles increased, even by very minute quantities. He exhibited and explained to the Section a working model of an engine, vide p. 239, in which—by the rotation of a cone of soft iron with a very obtuse angle, caused to roll on successive radial bars, arranged in a plane by the engine itself, when set in motion, caused to be successively electro-magnets with alternately attractive and repelling poles—an axle attached to the bore of the cone by a Hook's joint was made to assume a direct rapid rotatory motion, from which the required power could be taken off in the usual well-known modes. This engine had no dead points, and therefore required no fly-wheel.

"Experiments on Photography with Colour," by Mr J. B. Reade.

"On some Improved Celestial Planispheres," by Mr C. J. Villa.

"On some Models of Sections of Cubes," by Mr C. M. Willich.

October 8.

"On the Cohesion of Gases, and its Relation to Carnot's Function and to recent Experiments on the Thermal Effects of Elastic Fluids in Motion," by Dr J. Croll.

"On Capillary Attraction: Comparison of Theory and Experiment," by the Rev. F. Bashforth.

"Quaternion Proof of a Theorem of Reciprocity of Curves in Space," by Sir W. R. Hamilton.

"On the Storms of the St Lawrence Valley and the Great Lakes of Canada," by Dr Hurlburt.

"Some Facts relating to two Brilliant Auroras in Canada," by Dr Hurlburt.

"On the Probable Origin of the Heliocentric Theory," by Mr J. Schwarcz.—The author, in an elaborate essay, traces the origin of the Copernican system to Pythagoras, through Aristarchus the Samian and Archimedes of Syracuse.

"Remarks on the Complementary Spectrum," by Mr J. Smith.—The author endeavours to explain, on the principle adopted by him in his chromatrope experiments, the well-known fact that the spectrum of a hole in the window-shutter, when received on a screen, has the violet end above and the red below, but when looked at through the prism, the red appears above and the violet below.

"On the Supernumerary Bows in the Rainbow," by the Rev. J. Dingle.

"On Electrical Tensions," by Mr L. Clark.—The author describes at length the instrument, founded on the unit of one cell of Daniell's battery, by which he was led,—during the time he was conducting some experiments for the British Government on the phenomena which present themselves in connection with the manufacture and working of submarine telegraph cables,—to examine the tension or potential or force of electrical currents under various conditions, and thus led to some new and very interesting investigations of the properties of the voltaic couple, and some equally new experiments on the tensions at different points in the voltameter. The author concludes, from an examination of the intensity of the current at the zinc, at the copper, or platina, etc., plate, and at several points of the liquid interposed, that the entire force is developed at the zinc, and the copper, etc., plate is only of use as a collector and conductor of the electricity developed by the chemical action.

Section B.—Chemical Science.

October 2.

The President delivered an address.

"On the Luminosity of Phosphorus," by Dr Moffat.

"Description of a rapid Dry Collodion Process," by Mr T. Sutton.

"Remarks on Ozone," by Mr E. J. Lowe.

"On the Essential Oil of Bay, and other Aromatic Oils," by Dr J. H. Gladstone.

"On the Existence of Anilino in certain Fungi, which become blue in contact with the air," by Dr T. L. Phipson.

"On the Artificial Formation of Populine, and on a new Class of Organic Compounds," by Dr T. L. Phipson.

"Analysis of the Diluvial Soil of Brabant," etc., known as the Limon de la Hesbaye," by Dr T. L. Phipson.

October 3.

"Notes on the Decomposition of the Organo-Metallic Radicles," by Mr G. B. Buckton.

"On the Mode of preparing Carbonic Acid Vacua," by Mr J. P. Gassiot.

"On the Synthesis of some Hydro-Carbons," by Mr W. Odling.

"Modification temporaire et permanente apportée par la Chaleur à certaines Propriétés optiques du Feldspath orthose, de la Cymophane et de la Brookite," by M. A. Des Cloizeau.

"On the Adulteration of Linseed Cake with Nut Cake," by Mr W. H. Harris.

October 4.

"On a Photolithographic Process adopted by the Government of Victoria for the Publication of Maps," by Mr J. W. Osborne.

"On the Principles upon which Atomic Weights should be determined," by Mr G. C. Foster.

"On the Nomenclature of Organic Compounds," by Mr W. Odling.

"On Schönbein's Antozone," by Dr G. Harley.

"On the Action of Nitric Acid upon Pyrophosphate of Magnesia," by Mr D. Campbell.

October 6.

"On the Manufacture of Hydro-carbon Oils, Paraffin, etc., from Peat," by Dr B. H. Paul.—The author described the results that had been obtained at some works lately erected under his direction in the island of Lewis, N.B. The peat of that locality was described as a peculiarly rich bituminous variety of mountain peat, yielding from five to ten gallons of refined oils and paraffin from the ton. The results obtained at these works were contrasted with those obtained at the works of the Irish Peat Company some years ago, where the produce of oil was not more than two gallons from the ton of peat. This difference in the produce was ascribed, in a great degree, to the improper mode of working adopted at the Irish works. One of the most important points dwelt upon was the necessity of regarding the hydro-carbon oils and paraffin as the only products that would afford a profit in working peat; and the failure of the Irish works was attributed to the attempt to obtain other products which could only be regarded as waste, and not worth working, unless the oils

and paraffin were obtainable in a remunerative amount from the peat. Dr Paul concluded his paper by expressing his opinion that, though the working of peat was surrounded by many serious difficulties as regards its establishment and prosecution, there was every reason to believe that such peat as that occurring in the Highlands of Scotland could be advantageously worked; and that if the manufacture of oils were undertaken with earnestness and perseverance, it would become a means of greatly improving the condition of those parts of the country, and a fertile source of profit to those who carried it out.

"On a Particular Case of Induced Chemical Action," by Mr A. Vernon Harcourt.

"On the Nature of Nitrogen, and the Theory of Nitrification," by Mr T. Sterry Hunt.

"On some Principles to be considered in Mineralogical Classification," by Mr T. Sterry Hunt.

"On Hypobromous Acid," by Professor H. E. Roscoe.

"On the Essential Oils and Resins from the Indigenous Vegetation of Victoria," by Mr J. W. Osborne.—Mr Osborne drew the attention of the Section to the abundance of essential oils of indigenous growth in the colony of Victoria. The vegetation yielding them was to be found everywhere, forming in many instances large forests of miles in extent. Mr Osborne stated that the yield was in most cases exceedingly large: for instance, the *Eucalyptus amygadalina*, a very large forest tree, bore leaves which, with the twigs to which they were attached, gave, in the green state, as much as three pints of the oil from 100 lb. of the fresh material. Thirty-five specimens of oils were exhibited, all of which were possessed of valuable properties; some were of medicinal value, others as perfumes, and the great majority would be serviceable in the arts as solvents for resins used in the manufacture of varnishes and also for illuminating purposes, for which they were well adapted, as they burnt with a very white and clear light in lamps adapted for the consumption of paraffin oil, and were safe, inasmuch as they were ignited with great difficulty. The trees yielding these valuable products covered an area of the colony equal to 12,000,000 acres. Mr Osborne next referred to the resins of the colony from the gum-trees or genus Eucalyptus, the *Callitris verrucosa* and *cupressiformis*, from the *Xanthorrhœa australis* and the various species of the acacia, and described some of their properties and the purposes for which they were adapted.

OCTOBER 7.

"On the Effects of Different Manures on the Mixed Herbage of Grass Land," by Mr J. B. Lawes and Mr J. H. Gilbert.

"On some of the Difficulties arising in the Practice of Photography, and the Means of Removing them," by Mr M. Lytte.

"On a Simple Method of taking Stereomicrophotographs," by Mr C. Heisch.

"On Ferrous Acid," by Dr W. Odling.

"On the Means of observing the Lines of the Solar Spectrum due to the Terrestrial Atmosphere," by Dr J. H. Gladstone.

"On the Decay and Preservation of Stone employed in Building," by Dr B. H. Paul.

"On Aerolites from India," by Professor N. S. Maskelyne.

"On Columbite from Monte Video," by Professor N. S. Maskelyne.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, MANCHESTER.

At the last ordinary meeting of this association, Mr L. E. Fletcher, chief engineer, presented his monthly report, of which the following is an abstract:—

"During the past month there have been examined 353 engines and 539 boilers. Of the latter 9 have been examined specially, 9 internally, 48 thoroughly, and 473 externally, in which the following defects have been found:—Fracture, 7 (1 dangerous); corrosion, 30 (3 dangerous); safety-valves out of order, 15; water gauges ditto, 7; pressure gauges ditto, 20; feed apparatus ditto, 7; blow-off cocks ditto, 27; furnaces out of shape, 3; blistered plates, 5. Total, 121 (4 dangerous). Boilers without glass water gauges, 8; without pressure gauges, 7; without blow-off cocks, 18; without back pressure valves, 50.

"Three explosions have occurred during the past month to boilers not under the inspection of this association, these boilers were in the iron districts, and of the externally-fired hay stack class; they were reported as having been of original defective construction, being insufficiently stayed. One of these explosions was attended with fatal consequences, the engineman being killed.

INCRUSTATION AND SCUM PIPES.

"The number of boilers under inspection which suffer from Incrustation is very large; indeed, to escape this inconvenience is quite exceptional. It forms a considerable impediment to satisfactory inspection, since it renders it difficult to ascertain the actual condition of the plates; it sometimes gives a delusive appearance, and leads to undue suspicion of corrosion, but more frequently it conceals defects, since corrosion is often found to be going on under, and to be caused by, the deposit.

"In addition to the waste of fuel occasioned by Incrustation, the wear and tear of boilers is considerably increased, apart from the effects of over-heating. Thus internally double-flued boilers suffer from the undue longitudinal expansion given to the furnace crowns, which increases the tendency to groove at the front end plate, an action always more or less developed in these boilers, while Incrustation renders the use of tubular boilers altogether impracticable in localities not supplied with good water, and thus prevents the more general use of this economical class of boiler.

"Although the danger of allowing Incrustation to form on plates exposed to the action of the fire is too fully appreciated to need remark, the fact is not so fully recognised that even where no actual cake of deposits is formed, overheating frequently occurs. It is thought that this may, in many cases, be due to the presence of thickening matter held in suspension in the water, and it would be interesting to ascertain by experiment whether the impediment thus presented to the free escape of the steam does not—where the circulation is imperfect, or no such agitation of the boiler takes place as in locomotives when running—lift the water off the plates, and thus cause overheating. Of the fact of overheating occurring when no Incrustation is formed, and with an ample supply of water in the boiler at the time, there is no doubt, instances are constantly coming under notice, and it may be added that they are chiefly found to take place in boilers externally fired.

"Apart from the injury done to the boilers from Incrustation, a considerable amount of earthy matter passes over with the steam into the engines, and thus renders necessary the use of an increased amount of tallow for the piston and slides. This, though too frequently lost sight of, is illustrated by the fact that where boilers are fed from brooks, subject, on heavy rains, to sudden torrents which stir up the mud, the engine attendants are in the habit, at such times, of taking the precaution of giving the cylinders an extra amount of lubrication, finding the pistons, &c., to clog when this is neglected.

"Under ordinary circumstances, the most practical plan for the prevention of Incrustation is the adoption of an efficient mode of 'Blowing-out,' and not the use of 'Boiler compositions.' To blow out, however, from one point only, at the bottom of the boiler, which is the general custom, has but a very limited and local effect. This is frequently remedied by the adoption of a perforated pipe, which is connected to the ordinary blow-out tap, and carried along the bottom of the boiler from one end to the other. These are technically termed 'Topham-pipes,' from the name of the patentee, and are generally spoken highly of by those of our members who have adopted them. They are, however, more successful where the sediment being heavy and sludgy falls to the bottom, rather than where it is of a lighter character, which frequently forms the hardest and most tenacious scale.

"From the rapid ebullition that takes place within boilers when under steam, it is found that a greater part, if not the whole, of the sediment set free by evaporation rises to the top of the water, forming a coat of scum, before finally depositing itself upon the furnace tubes or shell; and thus the readiest way of preventing Incrustation is to blow out this layer of scum from the surface of the water by means of a Scum Pipe, before it has an opportunity of settling. There is nothing new or experimental in this, the system has been for years adopted with marine boilers, and there is no reason why its use should not become equally general with stationary ones. Many of our members have already tried it with considerable success, and find, on opening their boilers after a month or six weeks' work, that where they used formerly to be coated with a heavy muddy deposit they are now perfectly clean.

"The following is an explanation of the description of pipe adopted: It is about three or four inches in diameter, having a wing cast to it on each side, so as to form a trough throughout the entire length of the pipe. This pipe is carried within the boiler, from one end to the other, being made in any convenient lengths for introduction at the manhole; it is perforated with small holes on the top all the way along, the aggregate area of the whole number of these holes being equal to that of the pipe itself. The top of the trough is fixed a few inches below the level of the water, so that the scum on the surface may flow over it, when, being guarded from the disturbance of the ebullition, it deposits in the still water above the trough the sedimentary particles held by it in mechanical combination. A tap is fixed to the front end plate of the boiler, in communication with this pipe, by means of which it can be blown out as frequently as is desired, which should not be less than once every two hours, when ebullition is going on. This tap, which need not be more than two inches in diameter, should be entirely of brass, fitted with a gland, and have a neat waste pipe attached, which may be of wrought iron, while also the waste pipes from the glass water gauges may be connected to it, being led immediately under the dead plate, which arrangement is found to be very compact and convenient. The best position for the Scum Pipe is at the side and not at the centre of the boiler, both on account of facility in fixing, and convenience in getting inside. A single pipe is sufficient.

"The above description is not by any means given as if that were the only form of Scum Pipe that could be advantageously applied. It was designed for the use of the members as being adapted to stationary boilers, simple in construction, affording a large collecting area, and being free from any patent right. Upwards of a year's trial has proved it to be successful, and its more general adoption is consequently recommended. These pipes have already been made by the manufacturing engineers of Rochdale, Bolton, Bury, and other places, but are needed more generally, and a drawing at the office is open to inspection for the benefit of our members.

"There are other plans in operation which, however, are subject to patent right. One of these consists of a series of vertical pipes, fixed in the centre of the boiler, each pipe having a trumpet mouth, to which a vertical telescopic movement is given, to allow for the changes of water level, the movement being effected by a copper ball float, so that the trumpet mouth rises and falls on the changes of water level, like a buoy on the rise and fall of the tide; the object being to keep the mouth of the pipe immediately below the surface of the water, in close proximity to the scum. A second plan consists of a trumpet mouth laid horizontally. Both of these arrangements are reported to give satisfaction, and, whenever opportunity offers, the results of their working will be noted, and particulars of the plan found to be most successful communicated to the members.

"Some kinds of Incrustation, however, cannot be entirely removed by any blowing-out apparatus alone, however perfect; in such cases, a little carbonate of soda may be added, which many of our members have applied with considerable success. Of the use of this, their experience is decidedly in favour;

while the testimony with regard to complicated 'boiler compositions' generally is that they found them expensive, in many cases useless, in others injurious, and have, in the majority of instances, discoatinned them altogcther. For fuller chemical particulars refer to Dr Angus Smith's report to the Executive Committee upon the Incrustation in boilers. The use of soda without a Scum Pipe, is found in some cases to induce priming; the soda combiniag with the grease within the boiler, aad producing foaming of the water.

"The general adoption of Scum Pipes is, therefore, confidently recommended to the members, not only for the prevention of Incrustation, hut also, in order to lengthen the lives of their hoilers, as well as to assist the eagines ia many cases, hy preventing priming.

"The most radical cure for the prevention of Incrustation, though one involving considerahly more outlay, at the first, than the above, will be found in the adoption of dry or 'surface condensation,' by means of which the boiler is fed with distilled water, thc same heing used again and again, with the exception of the slight amouat lost through leakage. To those who are paying large amounts annually for a supply of town's water, aad where the steam is consumed for engine purposes, the adoption of surface condensers is well worthy of serious consideration, not only on account of the saving in the water rates, hut also in that of fuel, since non-condensing engines may, by this means, be converted into condensing, which is not at present generally the case where town's water is used.

INSTITUTION OF MECHANICAL ENGINEERS.

JULY 1, 2, and 3, 1862.—This was the annual special meeting, when Sir W. G. Armstrong, the President, delivered the usual address, after which the following papers were read:—"On Surface Condensation ia Marine Engines," hy Mr Edward Humphreys,—"On the Application of the Copying Principle in the Maaufacture and Rifling of Guns," by Mr John Anderson.

NOVEMBER 11, 1862.—Before commencing the business of the evening, the chairman said it was his duty to notice the loss the Institution had sustained by the death during the recess, of two of its most eminent members, Mr John Edward Errington, vice-president, and Mr. James Walker, past president.

For upwards of thirty years, and indeed ever since the introduction of the railway system, Mr Errington occupied a prominent position as an Engineer, and, in conjunction with Mr Locke, executed some of the principal railway works in Great Britain. He was, like his partner, Mr Locke, a strong advocate for economy in the first cost of construction. By his death, the profession had lost one of its most distinguished members, the Institution one of its warmest supporters, and many a sincere friend, and one ever ready to afford advice. Mr Errington had proved his attachment to the Institution, and his desire to see it prosper, by bequeathing to it the sum of £1000, free of legacy duty, and without attaching any condition whatever to the gift.

Mr. Walker was one of the oldest members of the profession, having been in active practice as an engineer for upwards of sixty years. He was also one of the earliest members of the Institution, having joined it in the year 1823, and, after the death of Mr Telford, became its president. For a period of eleven years, during which he so ably conducted its proceedings in that capacity, he was most devoted to its interests, and to his zeal and energy must be greatly attributed the eminent position it held on his retiring from the chair in 1845. Mr. Walker having left at Mr Burges' disposal the twenty-five remaining copies of Telford's "Life and Works," as well as the copyright and the copper-plates, Mr Burges had, in the most handsome and liberal manner, presented them to the Institution.

"On the Railway System of Germany," by Mr Robert Crawford, Assoc. Inst. C.E. It was stated that in Germany, as in England, tramways had formed the germ from which subsequent enterprise developed the vast network of railways now extending throughout the length and breadth of the land. The oldest of these undertakings originated in a fifty years' "privilege," granted by the Austrian Government, upon the 7th September, 1824, for the construction of a line from Budweiss, in Bohemia, to opposite Linz, on the Danube—a distance of upwards of 80 English miles, Subsequently, a concession was obtained for a line from Linz to Gmünden, 42½ miles. The cost of the Budweiss, Linz, and Gmüuden line was about £4877 per mile. The gauge was 3 feet 7½ inches, and it was worked by horses until 1854, when small locomotive engines were employed, first upon a portion of the liuc, and in the following year upon the entire length.

A proposal to adopt steam as a motive power, instead of horse-labour, was carried into effect for the first time in Germany in the case of a railway, 4 miles in length, from Nüremberg to Fürth, which was opened for public traffic on the 7th December, 1835. Thus Germany, possessing at the close of the year 1835, upwards of 108 miles of tramways, had up to the same time only 4 miles of railway properly so called. In the five following years, railways were introduced into all parts of the country, so that at the close of 1840, there were twelve railways, either wholly or in part finished, with a total length opened of 377 miles. In the next ten years this had been increased to 4,487 miles; by the close of 1860 to 8512 miles, and at the end of 1861, a total of 8866 miles had been constructed, at an average cost of £16,400 per mile. Nearly one-fourth of the entire length was provided with double lines of rails. About 38 per cent. of the existing lines was Government property, 10½ per cent. the property of Companies but worked by Governments, and 51½ per cent. the property of, and worked by private or Joint Stock Companies. Further, it appeared that 39½ per cent of the entire length was construeted by the different States, 21¾ by Companies under a guarantee of interest, or a Government subvention, and 35¼ per cent. by Companies at their own cost and risk; so that Government aid had been granted directly, or indirectly, to nearly two-thirds of the entire system. These 8866 miles of railway comprised sixty-two different undertakings, as at present constituted, under as many different organisations, and were managed hy nineteen Government departments, and forty-three boards of directors.

At the close of the year 1861, Germany had, in addition to the railways, about 143 miles of tramways, constructed at an average cost of £3200 per mile.

The gauge was now universally throughout the country 4 feet 8½ inches. With regard to curves and gradients the rules laid down were—First, the radius of curvature should, if possible, not be less than 3660 feet in level land, nor than 2000 feet in hilly districts, except in particular instances, where it might be necessary to reduce it to 1200 feet, or even, in very rare cases, to 600 feet, but never less. Second, the general scale of maximum gradients admissible on railways was 1 in 200 in level districts, 1 in 100 among hills, and 1 in 40 on mountain lines. Several examples of sharp curves upon works already executed were then noticed. The increased power of locomotive engines had led to a severer character of ruling gradients being introduced than was formerly contemplated, and there were ample proofs in every part of the country, that the limits recognised at present as suitable for the working of locomotives had been reached. Many instances were then given of steep gradients and sharp curves, including a particular account of the Semmering railway, and of the mode of working it. The ordinary rate of speed was fixed at—

	Ascending Miles per hour.	Descending Miles per hour.
For express trains - - -	14⅐	16½
" ordinary passenger - -	11¾	14⅐
" goods, including military transport - - - -	9½	9½

The maximum number of trains which had passed over the line in one day was seventy-two, counting both ways. This was during the Italian war. The ordinary number was twenty-seven, with from seven to eight carriages each. The line was about 25½ miles in length, was laid with a double way throughout, and had cost £98,270 per mile.

It appeared to be a general, although not a universal plan, in the case of all main lines, to prepare the earthworks and masonry for a double way throughout, but not to lay the second line of rails until the success of the undertaking and the requirements of the traffic demanded it. Some of the heaviest earthworks executed up to the present day were then alluded to, including one on the Southern State Railway of Bavaria, the greatest height of which was 172 feet, and which contained nearly 3,000,000 cubic yards of material.

Attention was then directed to the Permanent Way. It appeared that about seven-eighths of the rails in use were of the broad base, or contractor's pattern; the remaining one-eighth being composed chiefly of chair rails, with a small proportion of bridge-shaped ones. As to size the rails were not less than 4½ inches in height by 2¼ inches width of bead, and the surface was curved to a rudius of from 5 to 7 inches. They weighed generally from 66 to 76 lbs. per yard. Fish-plates were now almost universally adopted for connecting the ends of the rails, and the joints were always supported by a sleeper: a wrought-iron chair being interpossd hetween the rail and the timher. Recently, a trial had been made of the modern English system of leaving the joint free without any sleeper under it, and the result had been so satisfaetory that it was intended to extend it. The almost universal system of supports was that of cross-sleepers. They were of oak, where it could be procured at a reasonable price; but different descriptions of lareh and fir were often used, after being prepared hy some chemical process to resist the tendency to decay.

The quantity and description of rolling stock in use on different railways in Northeru and Southern Germany varied greatly; but as uearly as could be estimated, at the close of the year 1861, there were

Locomotive engines - - - - -	0·414 aer English mile.
Passenger carriages, average 41·8 seats each	0·807 "
Goods trucks, average load 6·9 tons - -	7·040 "

Before any engine was permitted to be used its boiler must be tested with hydraulic pressure to at least one and a half times the maximum steam pressure, which it was intended to sustain, and a similar test must be applied after the engine had run its first 46,109 miles, and be subsequently repeated every time an additional 36,887 miles had been made. The rate of speed was usually, for express trains, from 27 to 35 miles an hour, for ordinary passenger trains from 20 to 25 miles, and goods trains from 10 to 15 miles per hour, in each case exclusive of stoppages.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

OCT. 7, 1862.—"Memoir of the late Professor Hodgkinson, Part 2nd," by R. Rawson, Esq.

OCT. 21, 1862.—M. Jules Gerard delivered an address on Africa, in refereace to its future relations with Europe, and on the journey of exploration which he purposes to undertake in the former continent.

"On a Compressing Air Pump," by Dr J. P. Joule.—The author referred to the difficulties of realising in practice the theoretical advantages of the air, or the super-heated steam engine. The abrasion which takes place when metal rubs against metal, without an intermediate luhricator, speedily destroys the

cylinder. He believed that the necessity of using elastic packing would not exist if the length of the channel along which the elastic fluid must pass, in order to arrive at the opposite side of the cylinder, were sufficiently increased. This might be accomplished by increasing the depth of the piston, or by placing on the rim of the piston concentric rings to enter, at the beginning and end of each stroke, corresponding concentric grooves in the covers of the cylinder. The principle of great depth of piston, as a substitute for packing, had been successfully carried out in the pump which was the subject of this communication. The cylinders, two in number, are twenty inches long, and two inches in diameter. The pistons are solid cylinders of iron, ten inches long, fitting as accurately to the cylinders as is consistent with freedom of motion. The depth of each piston, as compared with its diameter, renders the usual guide or parallel motion unnecessary, so that the connecting rod is simply jointed to the top of the piston. Air is readily compressed to sixteen atmospheres, the quantity passing the sides of the cylinders being very trifling.

November 4, 1862.—Dr Roberts exhibited some microscopic preparations illustrating the effect of a solution of magenta on the blood.

Mr Dyer, vice-president, exhibited a broken screw bolt, 1½in. square (used to fasten a cart body to the axle). The fracture, near the head end, appeared very much like one of east-iron; imbedded in the centre of the bar was a smooth egg-shaped mass about ½in. diameter, crossing the fracture, and leaving a cavity as its mould in the metal on one side. He assumed that faults like this were probably owing to the rapid processes in use for reducing masses from the puddle into bars of wrought iron, whilst the metal was only partially converted to the malleable state, as appeared in this sample of bad iron. The iron, in a semi-fluid state, is passed from the furnace through a succession of rollers, without reheating or faggoting, as were formerly practised, and at once reduced to the sizes required. The improved rolling mills could not, it seemed, insure improved qualities of wrought iron, whilst they afforded temptations to make it far inferior to any that could have been made fifty years ago. Considering the many hazards to which life and property are exposed in travelling by railway and otherwise, from the iron "shuffled off in haste," and found in use in engineering constructions, it becomes important that previous tests should be employed to ascertain the real nature of the iron, so as to leave no question of its being in a safe condition for the purpose intended, and not like this specimen, and like much now-a-days made by pressing the half-converted puddle into marketable shapes.

In connection with the subject of the slow changes which iron undergoes, M. Breguet, of Paris, stated that in their furnace for preparing soft iron, he had observed a remarkable ease of crystallisation of wrought iron. One of the furnace bars became brittle, and on breaking a portion of it, he found it to contain a large cubical crystal of iron, each of whose sides measured five millimetres in length. This singular specimen is now in the possession of M. Balard.

"On a certain class of Linear Differential Equations," by the Rev. Robert Harley, F.R.A.S.

GLASGOW ASSOCIATION OF ASSISTANT ENGINEERS.

Nov. 4, 1862.—"On Slide Valves," by Mr. Foulis.

ON THE STRENGTH OF LONG PILLARS.

By B. B. Stoney, B.A.

Read before the Royal Irish Academy, June 23, 1862.

Among the numerous difficulties encountered in designing large iron structures, such as railway girders or roofs of large span, none perhaps is of more importance, or requires greater skill to overcome, than the tendency of parts under compression to deflect beneath the pressure, and yield sideways, like a thin walking-cane, when the load is greater than it can support without bending.

To understand the matter clearly, we must recollect that the mode in which a pillar fails varies greatly, according as it is long or short in proportion to the diameter. A very short pillar—a cube, for instance—will bear a weight sufficient to splinter or crush it into powder; while a still shorter pillar—such as a penny, or other thin plate of metal—will bear an enormous weight, far exceeding that which the cube will sustain, the interior of the thin plate being prevented from escaping from beneath the pressure by the surrounding particles. We can thus conceive how stone or other materials in the centre of the globe withstand pressures that would crush them into powder at the surface, merely because there is no room for the particles to escape from the surrounding pressure.

It has been found by experiment that the strength of short pillars of any given material, all having the same diameter, does not vary much, provided the length of the pillar is not less than one, and does not exceed four or five diameters; and the weight which will just crush a short pillar, one square inch in section, and whose length is not less than one or greater than five inches, is called the *crushing strength* of the material experimented upon. If the length of pillars never exceeded four or five diameters, all we need do to arrive at the strength of any given pillar would be to multiply its transverse area in square inches by the tabulated crushing strength of that particular material. It rarely happens, however, that pillars are so short in proportion to their length; and hence we must seek some other rule for calculating their strength, when they fail, not by actual crushing, but by flexure.

If we could insure the line of thrust always coinciding with the axis of the pillar, then the amount of material required to resist crushing merely would suffice, whatever might be the ratio of length to diameter. But practically it is impossible to command this, and a slight deviation in the direction of the thrust produces a corresponding tendency in the pillar to bend. With tension-rods, on the contrary, the greater the strain, the more closely will the rod assume a straight line, and, in designing their cross section, it is only necessary to allow so much material as will resist the tensile strain. This tendency to bend renders it necessary to construct long pillars, not merely with sufficient material to resist crushing, supposing them to fail from that alone, but also with such additional material or bracing as may effectually preserve them from yielding by flexure. It is evidently, therefore, of considerable importance that we should ascertain the laws determining the flexure of long pillars, which may be done as follows:—

Let the figure represent a pillar, very long in proportion to its breadth, and just on the point of breaking from flexure.

Let W = the deflecting weight;
b = the breadth of pillar;
d = its depth;
l = its length;
h = the central deflection;
R = the radius of curvature;
C = the resultant of all the longitudinal forces of compression on the concave side at the centre of the pillar;
T = the resultant of all the longitudinal forces of tension on the convex side;
δ the distance between the centres of tension and compression.

The longitudinal forces acting at the centre of the pillar are three, viz., the weight, W, acting in the chord line of the curve, the resultant, C, acting at the centre of compression in the concave half, and the resultant, T, acting at the centre of tension in the convex half. Taking moments round either centre of strain, we have approximately

$$W = \frac{T\delta}{h} = \frac{C\delta}{h}, \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{I.}$$

h being assumed equal to the distance between the chord-line and either centre of strain, which is a close approximation when the pillar is very long in proportion to its width.*

The values of T or C in different pillars are proportional to the number of fibres subject to strain, that is to bd, and δ is obviously proportional to d; so that we have the numerator on the right side of the equation proportional to bd^2. Again, assuming that the deflection curve is a parabola, from which it can differ but slightly,† we have

$$h = \frac{l^2}{8R};$$

but so long as the strain per sectional unit in the extreme fibres, to which their change of length is proportional, is constant, R will vary in the same ratio as d; and we have, therefore, h, proportional to

$$\frac{l^2}{d}.$$

Whence, by substitution,

$$W = K\frac{bd^3}{l^2}, \quad . \quad . \quad . \quad . \quad . \quad \text{II.}$$

in which K is a constant depending on elasticity of the material, which may be determined by experiment.

If the pillar be round, and if d represent the diameter,

$$W = K\frac{d^4}{l^2}, \quad . \quad . \quad . \quad . \quad . \quad . \quad \text{III.}$$

which proves that the strength of long round pillars varies as the 4th power of their diameter, divided by the square of the length; and the longer the pillar is in proportion to its diameter, the nearer will this formula represent the truth.

As all the longitudinal forces at the middle of the pillar balance, we have the following equation:—

$$C = T + W,$$

which enables us to predict how a long pillar will fail, whether by the convex side tearing asunder, or by the concave side crushing. A wrought iron pillar, for instance may be expected to fail on the concave side, as

* Mr Hodgkinson's experiments show that this investigation is not applicable to cast iron pillars whose length is less than about 30 times their width: even with such short pillars it requires certain modifications, which he has deduced from experiment.

† The curve will probably be intermediate between a parabola and a circle, approaching the latter if the pillar taper towards the ends.

its power to resist crushing is less than that to resist extension. A long pillar of cast iron, on the contrary, will probably fail by the convex side tearing asunder, as the compressive strength of cast iron greatly exceeds its tenacity. Further, the effective strength of wrought iron to resist crushing is about 12 tons per square inch, while the tensile strength of cast iron is nearly 7 tons per square inch; and hence we may conclude that the strength of long similar pillars of wrought and cast iron will be nearly as 12 to 7.

It is also worthy of note that, if the same pillar be bent in different degrees, T will vary as h, while δ remains constant; whence it follows from equation (I.) that w, the weight which keeps the pillar bent, is nearly the same whether the flexure be greater or less. This statement would be accurately true, were it not that equation (I.), on which it is founded, is only approximate. It will, however, agree very closely with experiment so long as h is considerable, that is, whenever the flexure is not slight. From this it follows, that any weight which will produce considerable flexure will be very near the breaking weight, as a trifling addition to it will bend the pillar very much more, and strain the fibres beyond what they can bear.

FRENCH ACADEMY.

MM. Foucault and Duboscq have shown a new model of the Heliostat, especially contrived for the production of enlarged images by photography. It sets in motion a mirror of 40 centimetres by 80, the greatest dimension of which always remains in the plane of reflection. At the exhibition, considerable surprise was excited by the fact of the small pendulum continuously moving so large a mirror.

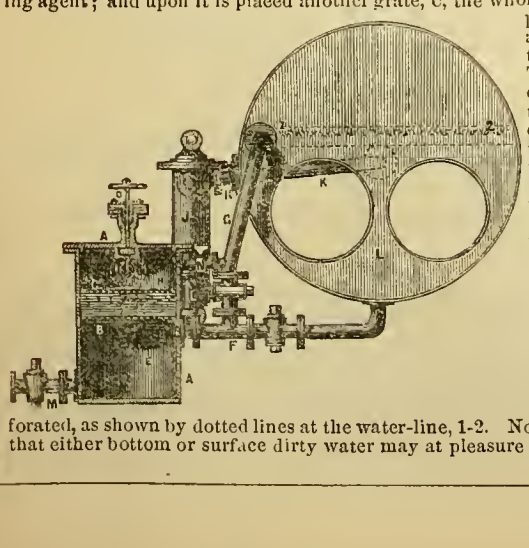
M. Kouig has recently contrived an apparatus for the measurement of the swiftness of the propagation of sound in air, gases, and liquids. The principle rests on the employment of the method of coincidences. The blows given by two electric counters, which strike simultaneously the tenth of a second, are at first heard as single strokes, when the two counters are near each other, all times that each is placed at a distance of a multiple of about 33 metres from the observer, a distance which sound passes through in the tenth part of a second. The sounds mix, but do not coincide, when the counters are at intermediate distances.

In a recent communication to this society, it is stated that the planet seen in September last, by M. Robert Luther, and proposed to be called "Diana," as a new discovery, is identical with "Dapbne," discovered by M. Goldschmidt in 1856, but lost sight of for six years.

M. Foucault, so well known for his great pendulum experiments in relation to the rotation of the earth, has also laid before the society the results of some further researches as to the velocity of light. Instead of the rate being 307 millions of metres per second, as calculated by Delambre's astronomical deductions, M. Foucault finds it to be 298 millions of metres.

MONTHLY NOTES.

Sykes' Mode of Preventing Incrustation in Boilers.—This apparatus is the one referred to in Mr Sykes' letter given in the *Journal* for last month. The patentee says:—The object of this apparatus is the removal from steam boilers of the earthy and other matters which are being continually precipitated therein during the formation of steam, or which may be mechanically carried into them along with the feed-water, before they have sufficient time to form scale upon the interior of the boiler. The principle of the apparatus is the conducting of the boiler water out from one end of the boiler into a proper filter, and the returning of the clean filtered hot water back again into the boiler, but at the other end than that from which it was taken, whilst the refuse may be ejected at pleasure. The subjoined engraving is a back end elevation of a Cornish boiler, having a filter apparatus, H, attached, and shown in section. The filter, A, is a cast iron cylindrical vessel, having a flange formed all round to support the grate, or perforated plate, B; upon this grate is placed a quantity of hemp, tow, hair, cotton, a bag of sand, or other filtering agent; and upon it is placed another grate, C, the whole being firmly pressed down, as desired, by the screw, D. The lower chamber, E, of the filter is connected with the bottom of the boiler by the pipe, F, to take the bottom dirty water, and at the water-line of the boiler to take the surface dirty water by the pipe, G, which is continued across the boiler and perforated, as shown by dotted lines at the water-line, 1-2. Now, it is evident that either bottom or surface dirty water may at pleasure be selected for filtration by means of the taps, in the pipes F and G. The impure water is conveyed by these pipes into the chamber, E, of the filter, the pressure of the steam forces the clean water through the filtering medium between the perforated plates, B and C, into the clean water chamber, H, along the pipe, L, into the barrel of the pump, J, and the pump forces it through the pipe and tap, K, into the front end of the boiler, L, thus a continued stream of hot pure water is pouring into the front end of the boiler, pushing the impure water to the back end of the same, to repeat the same course, whilst the dirt separated from the water remains in the lower chamber, E, to be ejected at will through the pipe and tap, M. When the filtering medium gets clogged with dirt it may receive a thorough cleaning by closing the taps in the pipes, F and G, and opening the taps, M and N, when a rapid stream of water will rush through the pipes, G and N, into the chamber, H; and if the pump, J, be standing, it will pass downwards through the filtering bed and plates, C B, with great velocity into the chamber, E, and out through the tap, M, carrying away with it all the refuse matters. The advantages resulting from its use to different branches of industry are very great. The boiler itself being clean inside is never heated to that high temperature, or burnt (except from shortness of water) as it always is when scale or loose dirt intervenes between the water and the boiler. By this means, the tenacity of the boiler plates is preserved, and as it is believed that incrustation is a fruitful source of explosion, there is no doubt that the application of the filter to steam boilers will greatly diminish the awful amount of loss of life and property arising from this source of devastation, whilst the heat of the fire will be conducted through the clean boiler plates to the water, with much greater rapidity, and, of course, generate steam in the same proportion, and, consequently, the heat of the fire gases will be more fully absorbed by the boiler, and effect a corresponding economy in fuel.



Progress of the Railway System.—It has been calculated that the railroads already constructed extend over a surface of 69,072 English miles in length, and have cost £1,151,163,446 sterling. These different lines are thus divided in various parts of the globe—viz., France, 9,890 kilomètres; Great Britain and her colonies, 22,971 kilomètres, of which 12,201 kilomètres are in England and Wales; 2,390 in Scotland; and 2,194 in Ireland. The remainder are divided as follows:—India, 2,265 kilomètres; Canada, 2,938; New Brunswick 281; Nova Scotia, 159; Victoria, 294; New South Wales, 201; the Cape of Good Hope, 45. Next comes Prussia, 9,896 kilomètres; Austria, 5,092; the other German States, 5,211; Spain, 2,333; Italy, 2,252; Russia, 2,202; Denmark, 421; Norway, 101; Sweden, 463; Belgium, 1,536; Holland, 495; Switzerland, 965; Portugal, 128; Turkey, 128; Egypt, 328; the Federal States of America 35,915; the Confederate States, 14,133; Mexico, 32; Cuba, 804; New Granada 80; the Brazils, 178; Paraguay, 12; Chili, 313; and Peru, 80.

The Supply of Wool.—Last year 147,172,841 lbs. of wool were imported as compared with 148,396,577 lbs. in 1860. In 1856 the imports were 116,211,392 lbs.; and in 1851, five years previously, 83,311,975 lbs. The regular increase of the consumption of foreign and colonial wool in the face of the well-sustained home production shows that the demand for woollen fabrics increases much faster than the population. The British settlements in Australasia never made such large deliveries as last year, 68,506,222 lbs. having been received from that quarter during the twelve months, against 59,166,616 lbs. in 1860, 52,052,139 lbs. in 1856, and 41,810,117 lbs. in 1851. The British settlements in South Africa also advanced to 18,676,286 lbs. last year, as compared with 14,305,188 lbs. in 1856, and 5,816,591 lbs. in 1851. The East Indics forwarded 19,161,004 lbs. last year, against 15,386,578 lbs. in 1856, and 4,549,520 lbs. in 1851. Of the whole 147,000,000 lbs. which came to hand from abroad last year, about 106,000,000 lbs. were consequently supplied by the British colonies, and only 41,000,000 lbs. by foreign countries, a very gratifying fact.

Foreign Microscopes in Great Exhibition.—Amongst foreign exhibitors, Nachet, Mirand, aîné, and Hartnach of Paris, were most conspicuous. Of these makers, M. Nachet had been at more pains to turn out neat work. His cases contained several forms of microscope, one of which was intended to enable two or more persons to examine an object at the same time. His binocular instruments were constructed on a design which is generally thought, on this side of the channel, to be inferior to M. Wenham's plan, which has been extensively adopted by English microscopists, and found to answer remarkably well. M. Nachet exhibited, amongst a few novelties, one of a double nosepiece. None of his instruments were priced, and we were therefore unable to compare them, in this respect, with those of other makers. But, as far as we were able to judge, not only his, but those of other foreign makers, were inferior in workmanship to the instruments of our best English makers, and not cheaper than the cheap instruments made here. M. Mirand, aîné, 57 Rue Galand, exhibited many instruments, the prices of which were certainly low, but of their quality we had no opportunity of judging. His instruments were more in the English style than those of the other foreign opticians. In the Prussian court, M. Nobert has succeeded in ruling glass with lines so close that they form excellent tests of the powers of object-glasses. Within a small space, only about the fiftieth of an inch in breadth, are placed the lines in question arranged in bands, each band having its lines closer together than in the preceding band, and consequently more difficult to resolve. On the first plate the distance between the lines ranges from the 1000th to the 6000th part of a Paris line, whilst on the last plate the interval is so much lessened that it becomes only the 10,000th of a Paris line, that is the 112,000th part of an English inch. The widest lines are easily separated by an objective of moderate power, whilst the closest lines absolutely defy the most powerful glasses hitherto made.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING NOVEMBER 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	d.	£	s	d	£	s.	d.	£	s.	d.
Bars, &c., British, per ton,	6	10	0	6	10	0	6	15	0	7	10	0
Nail Rods,	7	0	0	7	0	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	5	0
Sheets,	8	10	0	8	10	0	9	0	0	9	10	0
Pig, No. 1. Wales,	3	10	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	0	0	7	0	0	7	0	0	7	0	0
Rails,	5	7	6	5	10	0	5	0	0	5	0	0
Pig, No. 1, Clyde,	2	11	9	2	12	0	2	16	0	2	15	9
Swedish in boud,	10	5	0	11	10	0	11	0	0	11	0	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	10	0	15	10	0
In faggots,	15	10	0	15	10	0	15	10	0	15	10	0
SPELTER, ingot,	17	15	0	10	17	0	17	15	0	18	17	6
ZINC, sheet,	23	10	0	23	15	0	24	10	0	24	10	0
COPPER.												
Sheathing bolts, pr lb,	0	0	11	0	0	10¼	0	0	10¼	0	0	10¼
Bottoms,	0	0	10¾	0	0	11	0	0	11¼	0	0	10¾
Old,	0	0	9	0	0	9	0	0	9	0	0	8¾
Tough Cake, per ton,	93	0	0	92	0	0	92	0	0	92	0	0
Tile,	93	10	0	92	0	0	92	0	0	93	0	0
TIN.												
English blocks, per ton, duty free,	111	0	0	111	0	0	112	0	0	112	0	0
Bars in barrels,	112	0	0	112	0	0	113	0	0	112	0	0
Refined,	116	0	0	116	0	0	117	0	0	116	0	0
Banca, in bond,	115	0	0	115	0	0	116	0	0	115	0	0
Straits, ditto,	114	0	0	113	0	0	115	0	0	114	0	0
TIN PLATES.												
Char. IC. per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	2	6	1	2	6	1	2	6
LEAD.												
English pig,	20	0	0	21	0	0	21	5	0	21	10	0
Sheet,	21	0	0	21	10	0	20	10	0	21	5	0
Spanish pig, in bond,	19	10	0	19	0	0	19	5	0	19	10	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	4	0	0	4	0	0
Riga.	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	10	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	0	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	0	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	43	0	0	43	0	0	45	0	0	47	0	0
" yellow,	43	0	0	45	0	0	45	0	0	45	0	0
Sperm,	84	0	0	85	0	0	86	0	0	85	0	0
Cod,	39	10	0	41	0	0	41	0	0	41	10	0
South Sea,	38	0	0	38	0	0	39	0	0	38	10	0
Olive, Gallipoli, per tun,	57	10	0	58	0	0	59	0	0	60	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	51	10	0	51	10	0	52	0	0	52	10	0
Rape pale foreign,	52	0	0	52	0	0	52	0	0	53	0	0
Linseed,	1	14	9	1	16	0	1	16	0	1	16	9
Rough Turpentine, per cwt.,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	5	0	3	6	0	3	6	0	3	6	0
Hemp Manilla,	34	0	0	33	0	0	34	0	0	35	0	0
Jute,	16	0	0	16	10	0	23	0	0	23	15	0
Hemp Rope,	23	0	0	24	0	0	24	0	0	24	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

14th October, 1862.

2765. Edward Barlow. James Clouch, and Francis Hamilton, Bolton-le-Moors—Driving cottou gins.
2766. Jacob Snider, Dorset Street—Hansom cabs.
2767. Charles Harratt, Highgate—Ships' masts.
2768. D. and C. J. Reid, Newcastle-upon-Tyne—Cases for watches.
2769. Matthew Cartwright, Hoxton—Plates for artificial teeth.
2770. R. A. Brooman, Fleet Street—Carburetting gas.—A com.
2771. R. A. Brooman, Fleet Street—Dressing millstones.—A com.
2772. E. H. C. Monckton, Thurloe Place—Coils of inductions, and obtaining and applying power.
2773 O. J. and J. Showell, Manchester—Glass roofs and roof lights.
2774. Samuel Healey, Elizabeth Street—Zinc.
2775. J. H. Johnson, Middlesex and Glasgow—Sewing machines—A com.

15th October, 1862.

2776. Echlin Molyneux, Enniskery, Ireland—Carriages.
2777. William Wilson, Wigmore Street—Bagatelle and billiard table.
2778. J. H. Jenkinson, Manchester—Drinking fountains.
2779. Jacob Taylor, Oldham—Temples for looms.
2780. Charles De Bergue, Manchester—Crushing and treatment of ores.
2781. Charles De Bergue, Manchester—Permanent way of railways.
2782. William Pope, Cornwall Road—Armour plates.
2783. Patquale Potenza, Naples—Spinning the silky fibre of mulberry trecs.
2784. J. B. G. M. F. Piret, Paris—Lubricating apparatus.
2785 F. F. Prud'homme, Paris—Raising water
2786. John Bapty, Leeds—Preparing fibrous materials.
2787. R. A. Brooman, Fleet Street—Felting machines.—A com.
2788. R. A. Brooman, Flect Street—Refrigerating and freezing—A com.
2789. E. A. Cowper, Great George Street—Steam engines.

16th October, 1862.

2790. William Barningham, Manchester—Permanent way of railways.
2791. George Berry, Buttesland Street—Locks
2792. G. T. H. Pattison, Glasgow—Finishing woven fabrics.
2793. G. T. H. Pattison, Glasgow—Woven fabrics.
2794. H. A. Remiere, Paris—Horse collar.
2795. Florentin Delmas, Cloak Lane—A rain absorber.
2796. T. G. Harold, United States—Locks.
2797. Edward Humphrys, Deptford—Steering apparatus.
2798. Henry Ransford, West Brompton—Building vessels.
2799. J. and J. Cash, Coventry—Valentines.
2800. Joseph Robinson, East India Road—Protecting and ventilating iron ships.
2801. Edward Stely, Dublin—Envelopes
2802. Edward Nelson, Johnson's Place—Heating and superheating steam.

17th October, 1862.

2803. John Summerton, Smethwick—Harrows.
2804. Henry Wickens, Tokenhouse Yard, Bank—Making Nails.
2805. Jonah Davies and George Davies, Tipton—Rotary engines, rotary pumps, and rotary blowing machines.
2806 W. S. Kennedy, Queen's Road—Applying fomentations to the throat.
2807. G. T. Bousfield, Brixton—Iron and steel—A com.
2808. J. H. Johnson, Middlesex and Glasgow—Removal of incrustation from steam gencrators.—A com.

18th October, 1862.

2809. Richard Webster, Leeds—Preventiug accidents arising from collisions of railway trains.
2810. Edward Lord, Todmorden—Opening and cleaning cotton.
2811. Henry Ledger and Benjamin Williamson, Manchester—Substitutc for tombstones, tablets, monumeuts, and other memorials.
2812. John Bentley, Denton—Forming and pressing felt hats.
2813. Bernard Lauth, United States—Polishing sheet iron.
2814. R. A. Brooman, Fleet Street—Frames for doubling threads.—A com.
2815. John Fuller, Bishopsgate Street—Insulating wire.
2816. W. E. Gedge, Wellington Street—Extracting condensed steam.—A com.
2817. William Clark, Chancery Lane—Apparatus for dredging.—A com.

20th October, 1802.

2818. James Tangye, Birmingham—Pulleys for raising heavy weights.
2819. George Haseltine, Fleet Street—Forging cannon.—A com.
2820. R. A. Brooman, Fleet Strect—Transferring designs and prints produced by photography to stone or zinc.—A com.
2821. John Clark, Glasgow—Applying railway brakes.
2822. N. R. Hall, Rosherville, Kent, and M. L. Parnell, Strand—Thermometers.
2823. W. A. Turner, Lawrence Pountney Lane, and T. T. Coughin, King's Place—Measuring cloths, and indicating distances travelled by vehicles.
2824. J. B. Payne, Chard, Somerset—Spinning and doubling fibrous substances.
2825. H. L. Emery, Sloane Street—Endless chain railway horse powers.
2826. J. H. Johnson, Middlesex and Glasgow—Boiling liquids and cooking food, applicable also as a night light.—A com.

21st October, 1862.

2827. William Butline, Northampton—Splitting leather.
2828. William Tristram, Bolton—Preparing and dressing yarns.
2829. W. H. Tucker, Fleet Street—Self closing apparatus for doors.
2830. Joseph Bryam, Moldgreen, near Huddersfield—Lamps.
2831. Samuel Whitham and Thomas Wright, Wakefield—Iron and steel.
2832. C. G. Clarke, Owthorn, near Hull—Garden shears.
2833. Charles Clark, City Road—Cigar tubes.
2834. J. T. Cooke, Leicester—Battens for weaving.
2835. R. A. Brooman, Fleet Street—Water-proofing.—A com.
2836. G. T. Bousfield, Brixton—Boots and shoes.—A com.
2837. Joscph Duke and John Clever, Puriton—Cement.
2838. George Haseltine, Fleet Street—Manufacturing nails.—A com.
2839. Frederick Tolhausen, Paris—Raising, lowering, removing, and carrying buildings, monuments, and ships or vessels.—A com.
2840. Cooper Trees, Blackfriars Road, and F. C. Belhoumo, New Strcet—Hats, caps, and bonnets.

22nd October, 1862.

2841. George Clark, Craven Street—Construction, protection, and armament of ships, vessels, and batteries.
2842. James Spence, Portsmouth—Nonconducting compositions for coating metallic and other surfaces.
2843. Charles Webster, Radford—Self-acting fountains.
2844. Enoch Fielding, Willow Bank, near Todmorden—Healds.
2845. Henry Wilde, Manchester—Electro magnetic telegraphs.
2846. H. H. and J. F. G. Kromschroeder, Princess Terrace—Gas metres.
2847. E. W. Hughes, Great George Street—Turn-tables and turn-bridges.
2848. Thomas Fearn, Birmingham—Rods, poles, and tubes employed in articles of furniture.
2849. Thomas Greenwood, Leeds—Preparing fibrous substances.
2850. Valentine Orlowski, Worcester—Motive power carriages.

23d October, 1862.

2851. J. T. Stroud, Birmingham—Lamps.
2852. W. S. Gamble, Isliugton—An improved salinometer.
2853. Alexander Chaplin and George Russell, Glasgow—Obtaining fresh water by evaporation.
2854. John Turnbull, Barnard Castle—Mills for grinding grain.
2855. William Clark, Chancery Lane—Sewing machines.—A com.
2856. Edward Bath, Swansea—Treating alkali waste.
2857. M. C. A. Perkes, Rosendale, Dulwich—An equilibrium revolving rudder, self-balaucing drag, and improved stearing gear.—A com.
2858. Harry Ree, Hamburg—Exercising the human body.
2859. Hugh Donald, Johnstone—Bending or straightening metal plates.
2860. E. H. Carbutt and G. A. Clough, Bradford—Power hammers.
2861. Joshua Field, Lambeth—Steam engines, condensers, and boilers.
2862. R. A. Brooman, Fleet Street—Tanning.—A com.

24th October, 1862.

2863. A. J. F. Vigneulle-Brepson, Paris—A siphodial cistern with water reservoir.
2864. C. C. Burmeister and Wm. Wain, Copenhagen—Construction of "cupolas."
2865. Louis Groux, Victoria Soap Works, near Sheffield—Manufacturo of soap.
2866. Josiah Gimson and Robert Flude, Leicester—Looms for weaving.
2867. J. R. Nicholl, Streatham—Fireplace or stove grate.
2868. James Wright, Copthall Court—Seamless stays.—A com.
2869. J. T. Stroud, Birmingham—Steam, water, gas, and lamp fittings.
2870. P. S. Devlan, United States—Bearings, steps, and axle boxes.

25th October, 1862.

2871. G. and W. Luke, Birmingham—Buckle eye stirrups.
2872. John Carpendale, Sheffield — Producing raised chasing on metals.
2873. William Owen, Rotherham—Improvements in stoves.
2874. G. T. Key, R.N., Portsmouth—Fog and other signals.
2875. D. and W. Brown, Smethwick—Rolling gun barrels and cannons.
2876. J. A. Nicholson, Gracechurch Street—Lead, crayon, and other pencils.
2877. William Clark, Chancery Lane—Joiuts of gas and other pipes.—A com.
2878. Andrew Clark, Brighton—Bows and pendants of watches.
2879. Pierre Alfraise, Paris—Sewing machines.
2880. T. G. Ghislin, Hatton Garden—Fibres from foreign plants.
2881. E. A. L. Negretti and J. W. Zambra, Hatton Garden—Apparatus for testing the explosibility of liquid hydro carbons.—A com.
2882. J. P. Bourquin, Newman Street—Photographic albuuus.

27th October, 1862.

2883. Joseph Chattwood, Bury—Ventilating rooms and cellars.
2884. J. H. Johnson, Middlesex and Glasgow—Rotatory ougines.—A com.
2885. J. H. Johnson, Middlesex and Glasgow—Heating glass furnaces.—A com.
2886. H. C. R. Joubert, Maddox Street—Music chairs, stools, or seats.
2887. Frederick Lipscombe, Strand—Purifying water.
2888. W. J. Williams, Dorset Street—Field rakes for agricultural purposes.
2889. Thomas Pilgrim, Carlisle Terrace—Locks, bolts, and latches.
2890. F. L. H. W. Bunger, Gloucester Place—Discharging water of condensation. —A com.
2891. J. J. Ridge, Southwark—Treatiug farinaceous substanees.
2892. P. E. Placet, Paris—Engraving.
2893. Gustav Lindemann, Salford—Bricks, tiles, etc.
2894. Alfred Peek, Manchester—Evaporating saccharine and saline solutions.
2895. Thomas Richardson, Newcastle-upon-Tyne—Sulphate of soda.
2896. John Howie, Hurlford—Regulating the supply of solid or liquid bodies to mills, or apparatus for prepariug plastic matters.

28th October, 1862.

2897. James Chalmers, Wandsworth Road—Armour plating.
2898. Edward Hooper, Southampton—Roofing tiles.
2899. John Fletcher, Leeds, and John Fletcher, Newcastle-on-Tyne — Shaping iron and other uetals.
2900. E. and A. Tatham, Ilkeston—Warp machines for looped fabries.
2901. Horatio Allen, St James Street—Preparing loaves and stalks of plants for obtaiuing the useful fibres they coutain.
2902. G. H. Smith, North Perrott—Crinoline or elastic hoops.
2903. E. S. Tudor, Upper Thames Street—Purification of lead.
2904. C. S. Duncan, Bayswater—Coating or covering uetallic and vegetable snbstances to preserve them from decay.
2905. Julius Jeffroys, Hoddesdon—Surface condensers.
2906. Thomas Sutton, Jersey—Preparing albumenized paper for photography.

29th October, 1862.

2907. Abraham Ripley, Brook Street—Pistons for steam engines, air and liquid pnnps.
2908. Andrew Shanks and Ferdinand Kohn, Robert Street—Hydrostatic presses.
2909. George Darlington, Minera, Denbigh—Zinc oxide.
2910. Alfred Krupp, Essen, Prussia—Ereech loading ordnance.
2911. Adam Hogg, Londonderry, Glasgow, London, and Manchester—Smoothing irons.
2912. William Clark, Chancery Lane—Recording the distance travelled by vehicles, the flow of water, etc.—A com.
2913. William Clark, Chancery Lane—Treatment of copper ores—A com.
2914. I. W. Lister, J. and W Bottomley, Rochdale—Looms for weaving.
2915. William Cooke, Spring Gardens—Apparatus for ventilating.
2916. W. E. Evaus, Bayswater—Playing musical instruments.
2917. W. E. Gedge, Wellington Street—Pans of waterclosets.—A com.
2918. W. E. Gedge, Wellington Street—Looms for weaving.—A com.
2919. Daniel Fryer, Carlton Square, and J. W. Meears, Annett's Cresceut—Casks or receptacles for containing oils or spirits.
2920. Jeremiah Head, New Swindon, Wilts—Cultivating land by steam power.
2921. John Unsworth, Manchester—Steam engines.
2922. F. L. Stott, Rochdale—Warping yarns or threads.
2923. H. P. F. Newham, Nottiugham—Production of reversible shawls.
2924. John Fletcher, Leeds, and John Fletcher, Newcastle-upon-Tyne—Forming wrought iron wheels.

30th October, 1862.

2925. John Lockwood, Batley, York—Boilers.
2926. Henry Eastwood, Elland, York—Boilers and furnaces.
2927. Francis Gregory, Manchester—Pressing soeds, fruits, hops, &c.
2928. George Mayall, Liverpool, and John Hollingworth, Micklehurst—Preparing cotton.
2929. John Eaton, King's Norton—Gas burners.
2930. George Piggott, Birmingham—Punching and rivetting metal plates.
2931. Paul Giffard, Paris—Air guns.
2932. Joshua Horton, Etna Works, Smethwick—Armour plated ships.
2933. James Birch, New Norfolk Street—Clearing drains, water-closets, stach water and other pipes.
2934. Alexander Guild, Horbury Gardens—Treating fibre-yielding plants.
2935. George Haseltine, Fleet Street—Horse shoe machines.—A com.

31st October, 1862.

2936. William Astrop, Jubilee Street—Manufacture of paper.
2937. W. R Bowditch, Wakefield—Carburetting gas.
2938. H. L. Corlett, Inchicore—Construction of tuyeres.
2939. George Dickinson and Edward Cooke, Smethwick—Metallic bedsteads.
2940. Daniel Spink, Spaxtou, Somerset—Propelling vessels.
2941. Alfred Andrews, Birmingham—Rasping pegs in boots and shoes.
2942. Charles Gubbins, York Place—Irons for irouing.
2943. G. H. Morgan, Hereford—Raising and lowering bodies.
2944. Henry Thomsom, Buckden—Railway signals.
2945. M. C. de C. Sinibaldi, Greenwich—Armour plates.
2946. George Speight, St. John Street Road—Shirt collars.
2947. Henry Williams and John Maxton, Broadway—Lace or trimmings.
2948. Thomas Gibson, Berwick-upon Tweed, Thomas Hall and Thomas Davison, Gateshead—Railway breaks.
2949. W. E. Newton, Chancery Lane—Carriages of guns, &c.—A com
2950. F. E Sickels, Bute Street—Steeriug ships and lifting weights.
2951. J. G. Marshall, Leeds—Treatment of flax, hemp, &c.
2952. William Jenkins, Troedy Rhiw, Glamorgan—Cutting coal.
2953. J. J. Anderson, Northampton—Production of leather from waste leather scraps.

1st November, 1862.

2954. William Tarr and Enoch Farr, Manchester—Pianofortes.
2955 J. W. Taylor, Newsome, near Huddersfield—Scouring fabrics
2956. Edward Field, Buckingham Street, and M. & R. M. Merryweather, Long Acre —Steam fire engines.
2957. George Haseltine, Fleet Street—Burial cases.—A com.
2958. Ebenezer Stevens, Hunter Street—Iron shelves and racks.
2959. W. E. Newton, Chancery Lane—Drying grain.—A com.
2960. Evans Hopkins, Clarendon Gardens—Treating ores.
2961. James Winter, Wardour Street—Safety tap or cock.

3d November, 1862

2962. Felix Tussaud, Paris—Machines for cutting metals.
2963. James Musgrave, Bolton-le-Moors—Valves of steam hammers, &c.
2964 Clifton Shield, Newcastle-upon-Tyne—Malleable cast iron
2965. Louis Gones, Paris—A seat or chair forming also a travelling bag.
2966. Frederick Trachsel and Thomas Clayton, Manchester—Obtaining light, heat, and ventilation.
2967. George Hollins, Manchester—Belts for machinery.
2968. Edward Humphrys, Deptford—Centrifugal pumps.
2969. William Clark, Chancery Lane—Castors.—A com.
2970. T. O. Clark, Clapham Common—Spring bottom bedstead.—A com.
2971. Daniel Scattergood, Nottinghaun—Circular frames for looped fabrics.
2972. P. F. C. Cheveron and E. C. Eichenberg, Paris—Weaving Indian shawls.
2973 R. A. Brooman, Fleet Street—Artificial fuel, bricks, tiles, &c.—A com.
2974. W. H. Stallard, Mark Lane—Umbrellas and parasols.

4th November, 1862.

2975. J. B. Francis, Stretford—Raising and lowering window blinds, &c.
2976. Jules Lefebvre, Paris—Clitographs for indicating angles, &c.
2977. Francois Duraud, Paris—Cotton gin.
2978. John M'Kean, Walmer Bridge Mills, near Preston, and Thomas Grecnall, Manchester—Sizing or dressing yarns.
2979. J. H. Johnson, Middlesex and Glasgow—Arranging and operating ordnance. —A com.
2980. Thomas Logan, Kensington—Kalcidoscope.
2981. Joseph Place, Over Darwen—Looms for weaving.
2982 P. W. Renter, Buckland Crescent—Dyeing.—A com.
2983. Thomas Huntly, Manchester—Kitchen ranges and cooking apparatuses.
2984. R. A. Brooman, Fleet Street—Fringes—A com.
2985. Joseph Shirt and Charles Briggs, Tamworth—Coudensing steam.
2986. J. E. F. Ludeke, Marke, Hanover—Magneto-electric motive power.
2987. A. C Davies, Nicholl Square—Lubricators.
2988. Arthur Wall, Canton Street—Purifying lead.

5th November, 1862.

2989. J. B. Thomas, Paris—Working railway signal discs.
2990. Samuel Robotham, Birmingham—Carriage bodies.
2991. John Banwell, Watlington—Punching by hydraulic pressure.
2992. William Johnson, Glasgow—Pillars or standards for telegraph wires.—A com.
2993. R. A. Broomau, Fleet Street—Commodes or water closets.—A com.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 25th October to 14th November, 1862.

Oct.	25,	4517	Birtles and Gottwaltz, and Thomas W. Osborne, Birmingham—"Gas Singeing Lamp."
„	27,	4518	John Shrimpton & Son, Shedley—"Duplex Crochet Needle and Cap."
„	30,	4519	Simeon Greenberg, Birmingham—"Scarf ring."
„	31,	4520	W. H. Blanch, Liverpool—"Blanch's Improved Compound Rifle Sight."
Nov.	4,	4521	William Spurrier, Birmingham—"Egg Cup and Cover.'
„	6,	4522	Arthur James, Redditch—"A Needle Case."
„	11,	4523	G. P. Lempriere, Birmingham—"A Fastener for Boas, Victorines, Scarfs, Ties, and other articles."
„	14,	4524	W. N. Wilson, High Holborn, W. C.—"Needle-plate for Sewing Machines."

STEEL AND THE FUTURE OF SHEFFIELD.

Since the days of Chaucer, when, to complete the trim of his gallant, he tells us—

"A Sheffield whittle dangled at his hose,"

while it showed that already Hallamshire had become celebrated for more than the "quarrel head" of the cloth-yard shaft, Sheffield has had a wonderful development in its one great trade of steel.

It would be a task well worthy of some local scholar, to recover and publish whatever may have survived of the origin and history of the steel industry, and of the Huntsman, to whom is attributed there, the introduction of cast steel, more than 120 years ago. The vast extension of Sheffield trade dates from about that period downwards, though, by no means exclusively owing to the employment of cast steel. In fact, steel tools, grew with the growth of all our other manufactures; and the railway system opened a new field for employment, previously unknown, in the manufacture of springs, never needed on such a scale before.

The steel of Chaucer's day, and for long after it, was most probably produced by the same methods by which the Indian "wootz" is fashioned, and has continued for thousands of years to be made in Asia; the skill of the workman, and slight differences, in the exposure to fuel and blast, and in temperature, and time, and mode of handling under the hammer, known empirically, enabling him to produce, at will, iron, more or less soft, or hardenable steel. This method travelled westward, and was the foundation of the Damascus sword trade (to pass over Greek and Roman days) of the early Christian ages. With the conquering Saracens, it came into Europe, and in their hands, in Spain, gave northern celebrity to the Toledo blade. It is highly probable that much of the steel of early English weapons and cutlery was imported. The *origines* of the steel trade in Great Britain, however, are very obscure; it does not even seem to be known whether the Huntsman of 1740, was an Englishman, or a German, or of German descent, which latter we suspect to have been the fact, and that he only introduced that, which had been long before practised in Germany.

Interesting as it is to the scholar, and the historian of manufacture and trade, to look back upon the past of Sheffield, the looking forward to the marvellous future that is now opening out to it, is far more so. Little noticed, except amongst the very few, to whom the whole panorama of metallurgy is an open and well-discerned picture, and who are at the same time intimately acquainted with this single branch of metallurgy, siderotechny—the manufacture of steel is, nevertheless, at this moment, *the* great fact in the world of metals, and of every art dependent upon them, and is pregnant with consequences, some so great and marvellous, though neither remote nor distant in approaching fulfilment, that they can scarcely be grasped fully.

The fact, broadly stated, upon which the coming revolution, that will make wrought iron a thing of the past, depends, is no less than this; that a material has been found, capable of being now fashioned into every form, and of every size, that either cast or wrought iron has hitherto been given, possessed of much the same, or rather of something better, chemical qualities, as effecting its durability, etc. for all structural purposes, and which is *more than double as strong, and will ultimately be quite as cheap.*

The use of steel for purposes other than those in which its elasticity and capacity of keeping a cutting edge are alone concerned, viz, those in which its great resistance to extension and compression become valuable, is no absolutely new proposition; quite half a century ago, Chevalier Von Mitis, who was fully acquainted with the puddled steel that had been for a long time made in Silesia, and which, after being hammered, was employed for agricultural implements, and other coarse purposes, proposed to employ it for the links of chains for suspension bridges, and actually designed and constructed a bridge of this material at Vienna.

Puddled steel, however, had then begun to attract but little attention even in Germany, where all that belongs to metallurgy is so immensely better understood than with us; the prodigious developments of the machinery of steam locomotion, both structural, (in bridges, ships, etc.,) as well as dynamical, in engines, were required, before attention should be recalled to it. At length, Riepe, a German, patented this mode of making steel in Great Britain—a privilege that, with a better patent law, better administered, should never have been granted him; and the only effect of which upon the steel trade at large, has been to throw back and prevent the development, in Great Britain, of the puddled steel manufacture. In Yorkshire, and at Liverpool, however, puddled steel suddenly started into life about 1856 or 1857, and with results that at once showed its future importance.

In 1858, Mr Mallet conducted an extensive series of experiments upon the strength and other properties of this steel, and of the wrought iron, then, and still even now, to a great extent, employed for the largest shafts, cranks, etc, in heavy *forged* masses. The results were communicated in March, 1859, to the Institution of Civil Engineers, in a paper entitled, "On the Co-efficients of Elasticity, and of Rupture in Wrought Iron (and Steel), in Relation to the Volume of the Metallic Mass, its Metallurgic Treatment, and the Axial Direction of its Constituent Crystals."

In this memoir, which was awarded the Telford medal, he has proved that the iron of great forgings, such as huge, solid, forged guns, paddle shafts, cranks, etc., is unsafe at a tensile impulsive strain, of less than *two tons per square inch* of section, and that, within the limits of safety, the iron, after it has been forged into these huge masses, is reduced in resistance to about *one-half* that of the original faggot bars, from which it is piled up. In fact, wrought iron, in these unwieldy masses, is, in no respect, much better than some cast irons, nor as good as many are.

These facts, unanswerably based as they remain, were, for very obvious reasons, unwillingly received, by those who forge and sell, these great "uses," and by those who finish, and again sell them, as parts of marine and other engines. The author, however, sustained his experimental conclusions, by such an array of facts, as to the actual amount of breakages of wrought iron shafts, etc., obtained by an authenticated return from the Peninsular and Oriental Steam Packet Company, showing that, in five years and a-half, upon a fleet of forty-one steam ships, they had sustained, on the average, one break down of shafts or cranks, etc, *every two months*, and a dead loss of at least £80,000, in that period, by these; that no possibility of contradiction or cavil remained.

He then contrasted these shortcomings, unavoidable in heavy forged masses of *wrought iron*, with the properties of like masses of *puddled steel*, of which, as to both materials, he has given extensive tables, and diagram curves, of his experimental results.

He says, "On examining the properties of puddled steel, as shown in tables 25 to 31, its peculiarities, of great elastic range, extensibility, and ultimate strength, both tensile and compressive, will be observed; such as fully to entitle it to become the substitute of wrought iron in all the forms for which heavy forgings have been heretofore applied, as well as for girders, bridges, ship-building, and, indeed, almost every structural purpose to which plate or bar iron has been adapted. *In the largest bars, or heaviest pieces, its internal structure is nearly as fine and close in the grain, as in the smallest bar.* The elastic limit is above that of the best wrought iron, and the elasticity is so much more perfect, that, in practice, it may be trusted almost up to the elastic limit, of about 15 tons per square inch. The *final extension* at rupture is 0.67, or very nearly *seven-tenths of an inch per foot* in length; this *great extensibility*, united with its *high cohesion*, constitute the peculiarity and excellence of the material. It is not, like the cast steel of cementation, a harsh, glassy material, possessing, indeed, enormous cohesion, but yet so rigid and unaccommodating as to be untrustworthy; on the contrary, it combines the great strength of such cast steel, with the ductility of the best wrought iron."

He continues, "Puddled steel, though neither novel in aspect, nor, as regards its manufacture, by any means new on the Continent of Europe, is really to British manufacture, and far more, as applied to the countless

important purposes of British engineering, worthy of being viewed in the light of *an absolutely new metal*. It is precisely *the* material wanted for the production of artillery of the largest calibre; and if it can be produced by the manufacturers in proportionately large masses, and *with insured uniformity* of properties, must, ere long, become the universal substitute for heavy wrought iron forgings, as well as for very considerable portions of structural works, at present composed of boiler plate iron."

This prediction of 1859 has already, in 1862, shown itself a true prophecy. In fact, almost while it was being written, the Germans were making progress towards its fulfilment; and that they have done so, and to what extent, the magnificent collection of steel of Krupp, exhibited this year, abundantly proved.

We will let the Germans tell something of their own story, by the following article, which we have translated from the *Kölnische Zeitung*, of some weeks back—an influential journal, that devotes a portion of its space, very commonly, to subjects of German art and manufacture. The article in question is obviously written with a sensible leaning towards the Bochum Steel Works, and has, perhaps, a little too much of the German characteristic, of beginning at the beginning; it is not the less, however, a *resumé* of the Westphalian steel manufacture:—

THE STEEL CASTINGS IN THE LONDON EXHIBITION.

This summer completes the half century since the mighty Corsican reviewed the warriors of well-nigh half Europe, whom his iron will, had enlisted under his standard, for that proudly begun, but mournfully concluded, campaign to the far East. Between *then* and *now* lies a memorable time;—Europe, over spread with railroads, and crossed with telegraph wires, has, as it were, become smaller, her countries and cities have approached nearer, and their mutual interests and influences have infinitely increased in number and strength. From eternal peace we are indeed as far removed as ever, but the nations now luckily contend for other aims, and with other weapons. Whilst 50 years ago Europe was desolated by bloody battles for conquest, in our days the nations strive for progress and advancement in the intellectual and material world. If war be still an inevitable stand point, yet the arts of peace are the weapons of which the best and most lasting trophies are obtained. Among these, industry and trade competition take an important place. The toil of a people in its workshops and manufactories, has an essential influence on its position in the great family of nations, so that industrial products share with the combatants in this general contest for the superiority of a nation; and it was an excellent thought, pregnant with important consequences, to marshal the products of all nations in mighty array, bringing before our eyes all the efforts and struggles of our age. This thought is realized in the present London Exhibition for the third time. The noble Prince who conceived the idea of such a World Exhibition, rests for a year in the vault of Windsor Castle, but upon him, the hero of peace, earth will rest lighter, than upon the mighty Emperor, around whom, in nightly review, we may imagine assembled the invisible hosts who fell a sacrifice to his world-storming ambition.

As the least result of the London Exhibition, each nation must strive to show that, on the whole, no decline is apparent in its industry, since the last general comparison in Paris. This is no inevitable sequence; for he who only stands still, while others advance, is left behind, and the transit from standing still to real falling back, is as rapid as that from good to evil. The German nation, God be thanked, ranks with those that are progressing, and its industry naturally has a share in the advancement. It not only maintains its past success, but manifests in-dwelling life-power in many ways. We shall turn our attention to only one of these—the improvement in the manufacture of steel, which appears of especial importance for the future industrial activity of our fatherland. The more vigorous our industry, the more we shall need iron and steel; and the art of fabricating and manufacturing these, has a beneficial reaction even on the sphere of science.

Raw or pig iron, as is well known, is obtained by smelting from the ore. This, when again melted into special forms, is called cast iron, and is extensively used for machinery, buildings, and innumerable articles of daily life. Raw pig and cast iron contain from 2 to 5 per cent. of carbon; this, by a peculiar process of re-melting (puddling), is reduced to a mere trace, and the raw iron is converted into malleable iron. The principal physical difference of these two kinds of iron is alluded to in their respective names, cast and forged iron (guss und schmied eisen.) The desired form can only be given to cast iron, while in a state of fusion, by pouring it into a corresponding mould; and the shape can then only be superficially altered by turning, planing, and boring; neither a cold nor heated piece of cast iron will assume another form from hammering or pressure; when force is used beyond narrow limits, it breaks, for it is too brittle to bend. Malleable iron has exactly opposite properties. It is not fusible at the temperatures which the metallurgist usually attains in forges and furnaces; cold, it is flexible, ductile, and tough, and, at a red heat, becomes a firm, pasty mass. The forge hammer heats it into various objects, and, under the roller, it is stretched into thin plate, or drawn out into fine wire; and two pieces of malleable iron, at a white heat unite into one, from pressure or hammering, *i.e.*, they will weld together. Cast iron will only re-unite in the melting furnace. Each has thus a distinctive and valuable characteristic; one is fusible, the other malleable, and one peculiarity excludes the other. Were it possible to introduce a third kind of iron, which should combine both these advantages of cast and malleable iron, this material would be of the highest importance to trade, and there is such a material. viz., steel.

What is steel? The answer is not easily given. According to the general notion, steel is iron *chemically combined* with from half to two per cent. of carbon. This definition asserts nothing wrong; but it is incomplete, for it does not explain *how* the iron is united to the carbon, nor say whether another element, called in modern times azote, is essential to the formation of steel. The constitution of steel is yet, in part, an unsolved question to science, but notwithstanding, as in other like cases, experiment has succeeded in discovering several methods of making it. As steel contains less carbon than cast iron, but more than malleable iron, there are two principal ways of procuring it. It is obtained by depriving cast iron of part of its carbon in the "rough steel," or puddling furnace. The steel so made has been used for several years in Germany, and furnishes the so-called "puddled steel." Steel is also procured (cementation steel) by heating malleable iron with charcoal powder, the carbon combining with the iron. All steel is fusible, but cementation steel is not reduced to a liquid condition in its production. When cementation or puddled steel, are fused separately, or together, the product is cast steel. The fusion of steel and iron, with or without the addition of carbon, admits of great variation; and the possible changes of the mixture result in the formation of very different qualities of steel, in accordance with its present varying applications.

Cast steel is, in its nature and properties, the highest development of iron. It has, it is true, its most important characteristics in common with other kinds of steel, but possesses these in a higher degree. Owing to its once liquid condition, its mass is uniform (homogen); and yet, like other steel, it can be wrought, as malleable iron, under the hammer and roller. Its strength is, at least, double that of malleable iron, which renders it of such importance in machinery and railroads. We now employ machines with steel moving parts, iron, in many cases, not being sufficiently strong. Cast steel, of suitable quality, also receives an especial temper when heated, and then suddenly cooled; a widely spread, but erroneous, opinion prevails, that all cast steel is tempered. This arises from the fact that the greater part of the steel used, in daily life, for tools and utensils, *is* tempered; and the extensive machinery, axles, and tires, made of untempered steel, are little known to the public.

The first manufactory of cast steel was established in Sheffield, in the year 1740, by Huntsman; and, till this century, he had no successful followers, except in England. The exorbitantly high price of steel was, meanwhile, a strong inducement to attempt its production elsewhere. Germany was not behind hand, and has had the happiness of possessing men, who not only imported the English mode of manufacture to their own land, but, by improvements and new inventions, raised it to such a height that, in the present day, the German manufacture of cast steel surpasses that of all other countries. England succeeded in producing cast steel of such superior quality, that, in this respect, no material advance has been made upon it; but the size of the individual pieces, which the manufactory furnished, was so small, that, necessarily, only tools, weapons, and fine articles of all kinds, were made of cast steel. There appeared, in the London Exhibition of 1851, a block of cast steel of almost 5000 lbs. weight, exhibited by Herr Krupp, of Essen. The astonishment which it produced was general and great; it could not have been greater had a skilfully cut diamond, of a pound weight, been produced; and such a gem would have been of much less importance, for, to the existence of a block of cast steel of several thousand pounds weight, was attached the possibility that this strong material might no longer be limited merely to the fabrication of chisels, and files, and other small articles, but could be used for machinery, and the construction of railroads and carriages. That block opened a new career to cast steel, while it proved that no limit to its size existed, save in the extension of the furnace and other plant; and that this limit can be widely stretched, Herr Krupp demonstrates by the block of 40,000 lbs. weight sent to the present Exhibition.

In the English factories, as well as in Krupp's foundry, only blocks of the most simple form were, and are still, produced, the steel melted being poured into cast iron moulds. These blocks acquire, in process of working, the same character as finished bars (fertigen luppen) in the manufacture of iron, which can only be enlarged by the welding on of other pieces, and, like these bars of iron, the simple steel blocks are fashioned into objects of varying form and size, by hammers, rollers, and other mechanical means. This kind of steel manufacture has been marvellously improved in Krupp's work. He has gained for himself the double merit of producing in his melting works, steel blocks of the

best quality, and of every desirable weight, and of afterwards fashioning them in his forges, and mechanical workshops, into objects which none before him had ever made of cast steel. In addition to many other things, Krupp has furnished cast steel axles for marine engines, locomotives, and rail-carriages, and cannon, from the lightest to the heaviest calibre. Even a square steel block is fashioned by mechanical means into a round wheel-tire of one piece, and without being welded. All that can be made from a simple steel block, by the agency of mighty hammers, and turning, boring, and planing, is executed by Krupp with a skill as yet unsurpassed.

By this method of fabrication, those properties of cast steel, which it possesses in common with malleable iron, are turned to the best advantage; but the other qualities found combined in it—its fusibility, and capacity for *casting*, are not fully brought forward. Perhaps many a reader has already remarked this, and inquired, with surprise, *why* only simple blocks are cast from the molten steel, and not, as with cast iron, all those objects which, owing to their complicated form, are forged with difficulty. It is, apparently, quite as simple to employ cast steel in the same manner as cast iron; and the great advantages to be gained by so doing lead to the presumption that attempts have not been wanting, since the first cast of molten steel was seen; but all attempts were long unsuccessful. No cast forms, properly so-called, could be obtained from steel by any of the methods in use, with other metals. A new discovery alone could reach the goal.

Of all who strove with this aim, one only was successful: Herr Jacob Mayer, the founder of the Bochum Steel Manufactory, and the present scientific director of these works, for the manufacture of cast steel.

With the untiring perseverance of years, and the energetic faith of a man who is urged forward by the consciousness that he will at last overcome all difficulties, Herr Mayer has completed his task, and discovered the method and way to make, in steel, true castings, answering every purpose. Thus an important service has been rendered to science, for now only is it possible to profit, in an efficient manner, by the great advantages which cast steel unites in its double nature. Many objects which prove too weak when made of cast iron, and which are very expensive, and, perhaps, still defective when made of welded steel, or malleable iron, can be cast directly from steel, in consequence of Herr Mayer's discovery, and are not to be surpassed in excellence. Again, things which are first cast, can be subsequently prepared by hammers and rollers. While, for iron, casting and forging are two completely separated regions, Herr Mayer has, for cast steel, thrown down the partition wall, and summoned the former to the assistance of the hammer and roller. Of course, steel casting has narrower limits than iron casting. The extraordinarily high fusing temperature of cast steel, and its imperfect liquidity when melted, hinder the casting of as fine objects from steel as from iron. The boundary may be somewhat enlarged, but can not be entirely removed. It is, however, practically, of little importance, and is no hinderance to the employment of cast steel for many useful purposes. Some specimens, forwarded by the Bochum Company, to the London Exhibition, deserve especial notice; and we may be allowed to speak of them in particular. Relative, however, to the peculiar manipulation of these castings, nothing can be communicated, for this is the secret of the Bochum Foundry.

Church bells were the first castings which Herr Mayer attempted with his new method. When these were first exhibited in Paris, in 1855, their motto, "May their first chimes be peace," was not fulfilled, for a violent controversy arose about the material itself; and the question, whether they were steel or cast iron, divided the men of the department into two hostile factions. A mighty authority (ruled by the thought, *I* am *the* manufacturer of steel) would not allow that they could be cast steel bells; but Herr Mayer incontestably proved that they were so by breaking one of them. The jury awarded the large gold medal of honour to the Bochum Company; opposition was silenced; friends acknowledged, and adversaries could not gainsay, that the discoverer of cast steel had a formidable rival in his territory. Since then, many hundred steel bells have been cast. The advantages which the new bells possess over the old (which do not surpass them in clearness, or loudness of tone) are greater durability and strength, with nearly the same size and form, and well nigh half the expense. This last circumstance has enabled many poor churches to rejoice in the chime of a bell. The Bochum Company exhibit in London a steel bell of 8½ feet in diameter, and nearly 20,000 lbs. weight. "Let her name be Concordia."

The next important application of Herr Mayer was in favour of railways. The wheels of rail-carriages and locomotives, like those of common roads, are secured with a tire, only necessarily much stronger. They are usually 2 inches thick, and 5 or 6 inches broad, and have, in order to prevent their running off the rails, a flange on one side—*spur kranz*. Formerly, wheel tires were constructed of iron or puddled steel. Both these materials permitted no other mode of fabrication than bending into the wheel tires, a straight bar forged for the purpose, the ends of which were finally welded together. The weld is the weak point of the tire, and, on account of the great danger connected with its fracture, has absorbed much attention. Tires, without a weld, were long the desideratum of railway constructors. Herr Krupp was the first who gratified their wishes, and furnished unwelded tires of cast steel—the best material for the purpose in existence. His method of manufacture, so far as it is known, is as follows:—First, a long flat block is cast; this is hammered out; a long, slot-like hole is pierced along through the middle, and, by wedges, it is gradually extended, while hot, into a ring; and, lastly, it is made round on a central roller *(centrir walze)* passed through it. Instead of this difficult method, another is employed in the Bochum works, by which the production of steel tires is much simplified. The discovery of Herr Mayer renders it possible to cast the tire with the flange upon it; this, like every other casting, must be freed from the mould; in this state, it has only half the finished diameter, and is enlarged by the stretching it undergoes between the central rollers; these are driven by a nearly 300 horse-power engine at Bochum. This Bochum method of wheel-tire manufacture is a fair example of the extent to which the preparation of steel can be facilitated by the preliminary operation of casting; in fact, casting and forging should go hand in hand. On the German railroads, thousands of Bochum tires are already in use, and highly approved of. Among those sent to the London Exhibition, is one of the unusually large diameter of 9½ feet, and another, which has been bent close double in the cold state, to show the toughness of the material. As cast steel tires (on account of their greater durability, and consequent less wear and tear) are of the greatest importance to the railway interest, the companies have much reason to thank the Bochum Company, since, by their method of production the price has been reduced by one half.

To secure the tire on the wheel frame, the contraction, consequent on the cooling of the tire applied while red hot, is made use of; tension ensues, and the strength of the wheel depends on the care with which the fitting is adjusted. This initial strain exposes the tire, under certain circumstances of temperature, to the danger of bursting. The tire is also rendered thinner by the wear of the brake, and continued rolling in use, expands and loosens the tire from the wheel. These evils might be obviated, and cast steel wheels brought to the highest perfection, if they could be fashioned in a single piece. In any case, this is a very difficult task for the founder, and, till recently, no steel block was ever changed by the hammer into a wheel. But the inventor of castings in steel, has succeeded in casting, by his own method, a railroad wheel, in which the tire, spokes, and nave, are one single piece. This cast steel wheel is the best of all wheels yet invented for railway carriages, and it would be difficult to surpass it. It is (if not in first cost, at least in use) cheaper than ordinary wheels, provided with steel tires; and it has the great advantage of being strong, light, and needing no repairs. The Bochum wheel is exclusively the work of steel casting, and neither hammer nor roller is used in its fabrication. When taken from the mould, and freed from the sand, it is carefully annealed for the removal of any internal strains (spannung) due to contraction, and then completed with the assistance of the boring and turning lathes. In the spring of 1860, the Bochum Company first came publicly forward, and proved, by comprehensive experiments, in the presence of a large assembly of railway contractors, the advantages and superior strength of this new manufacture, which soon became extensively employed on the German railways. In an International Exhibition, this invention appears in London, now, for the first time. The Bochum Company has sent thither two cast steel axles, with wheels attached; one pair of wheels is just as it would be furnished to the railroad; but, the other is turned and polished, and shows, by its unblemished surface, how completely Herr Mayer has overcome the difficulties of moulding in steel, and succeeded in producing a clean and solid casting. Besides these carriage wheels, there are two locomotive driving wheels exhibited, in which the bosses for the shaft and crank pin have been also cast; steel wheels, for locomotive tenders, have been in use for some time, and have surpassed all expectations. It has been the fate of many a German invention to meet with its first honours in a foreign land, or to be plundered by strangers; but a happier destiny is allotted to steel casting. The Bochum Company has the means of keeping the invention on German ground, and enabling it to take root, and come to perfection, on the spot where it first saw the light. Their great foundry, in which every kind of cast steel is manufactured, has undertaken, as its principal business, the supply of articles for the railroad trade. In addition to these articles, the Bochum Company has furnished cast steel axles, and springs for locomotives, and railway carriages, of superior excellence. Its extensive workshops are furnished with the best tools and furnace apparatus; and, by their aid, and the toil of upwards of a thousand men, as much as 40,000 lbs. of cast steel are daily produced and manufactured.

Amid the treasures and splendour of the London Exhibition, the contributions of German steel have been, by many visitors, scarcely remarked; and yet they are of great importance, and point to one of the most remarkable advancements of this age, in the working of metals. This progress is the more important, because it concerns *steel*,

the material which is destined to take the place of iron, as the man springs up from the boy.

Such is the Westphalia of to-day, as regards its steel manufacture; one every hour being, more and more, developed with her.

Both the Essen (Krupp) and the Bochum steel, for casting and heavy forgings, are, we believe, (for the doors are kept rigidly closed against inspection generally, although we have ourselves had the advantage of having been through a considerable portion of the Bochum works) made by the puddling process; and the sole peculiarity, by which uniformity is secured in their great steel castings and forgings, consists in this, that the masses of puddled steel, after they come from the shingling hammer, are broken up, and carefully examined, and those of precisely similar texture in fracture are selected (just as the Low Moor Company have been, for years, in the habit of doing with reference to their blooms of iron to be re-wrought) and laid aside. These uniformly-alike masses are then melted in clay crucibles, which hold a centner (100 Prussian pounds) each; and by unitedly pouring the contents of a great number of these (400 for a 20 ton casting) into one mould, the largest blocks are cast, and of perfect uniformity. The moulds appear to be "rammed up" of a very infusible siliceous grit or sand, with a small amount of pure fireclay loam to give it adherence, and are, apparently, faced with "black wash," like ordinary dry sand moulds for cast iron; but whether of charcoal, or of pit coal, we cannot say.

Much mystery is affected, as to the material of these moulds—the boxes or flasks of which, are much the same as for ordinary iron foundry uses; but the only point of difficulty is to obtain a material that shall not fuse partially into a hard crust, at the extremely high temperature of the fluid steel, and become so adherent as to be with difficulty detached from the surface of the latter. "Venting the moulds" by the "vent wire," is rendered less needful, by always casting the metal through a relatively very wide "gait,' or into an open mould, when the article is only an ingot to be subsequently forged.

Great as is the progress already made in Westphalia in steel manufacture, Sheffield will, we believe, run her hard in the race now beginning; and aided by the Bessemer process, which, we strongly are of opinion, will, in the end, be found greatly superior to the puddling one—for steel, at least; we predict that we shall far surpass our German rivals in magnitude and facility of production of steel in great forged or cast masses; and, we hope, also in superiority of quality.

Already, along the line of the Midland Railway, at both sides, where it passes through Sheffield, manufactories of the largest class have sprung up, for the production of heavy steel; amongst these, one of the most remarkable is that of Messrs Brown & Co., Atlas Works, who are engaged in the production of soft iron armour plates by the rolling process, as well as steel. They have two converting vessels, upon the Bessemer patent, at work, each producing 4 tons of cast steel at each operation; with the two, they can produce 24 tons of steel a day. Mr Bessemer himself, at his own works, upon a somewhat less scale, produces a large quantity; and Messrs Cammel & Co., Cyclops Works, are at present constructing very large new works specially for Bessemer cast steel, of the heaviest class. Nearly the whole of the steel now made by this process is subsequently forged into axles, shafts, cranks, gun moulds, etc.

Sound steel castings, of finished objects, are, at present, not attempted to be made, by pouring directly from the Bessemer converting vessel; the mass of metal in this, as may naturally be expected, appears to be *boursouflé*, more or less, and, probably, is even in act of evolving gases, that make it porous. But uniformity of chemical constitution of the metal, to the extent of the large capacity of the converting vessel (say 4 tons in one mass) is insured. This might be run into thin ingots, broken up, and melted again, for steel castings, in crucibles, as by Krupp and Mayer, or in some still better, and more fuel-and-labour saving way.

All that is wanted, in fact, now, to enable steel castings to be made quite as good, if not better, than the German ones, of any size, and, at a greatly reduced price, is an air furnace, suited to melting the steel in large bulk, and without deterioration of its quality.

The Emperor of the French, with that perfect information and sagacity, that so distinguish his liberal movements in promotion of metallurgy, has devoted a large sum of money to experiments for the production of such a furnace, and it is understood with, already, considerable success. When this shall have been achieved, we shall have seen the "beginning of the end" of wrought iron as a structural material; and once the tide sets in, the change will be as rapid and sudden, as was that by which, twenty years ago, cast iron was, to a great extent, structurally superseded by wrought iron.

Here, however, the permutation will be even more thorough and universal; the saving of weight—safety—the boundaries of mechanical possibilities widely extended—and many other conditions, will all conspire towards an almost universal substitution of steel for wrought iron, *and for cast iron likewise.*

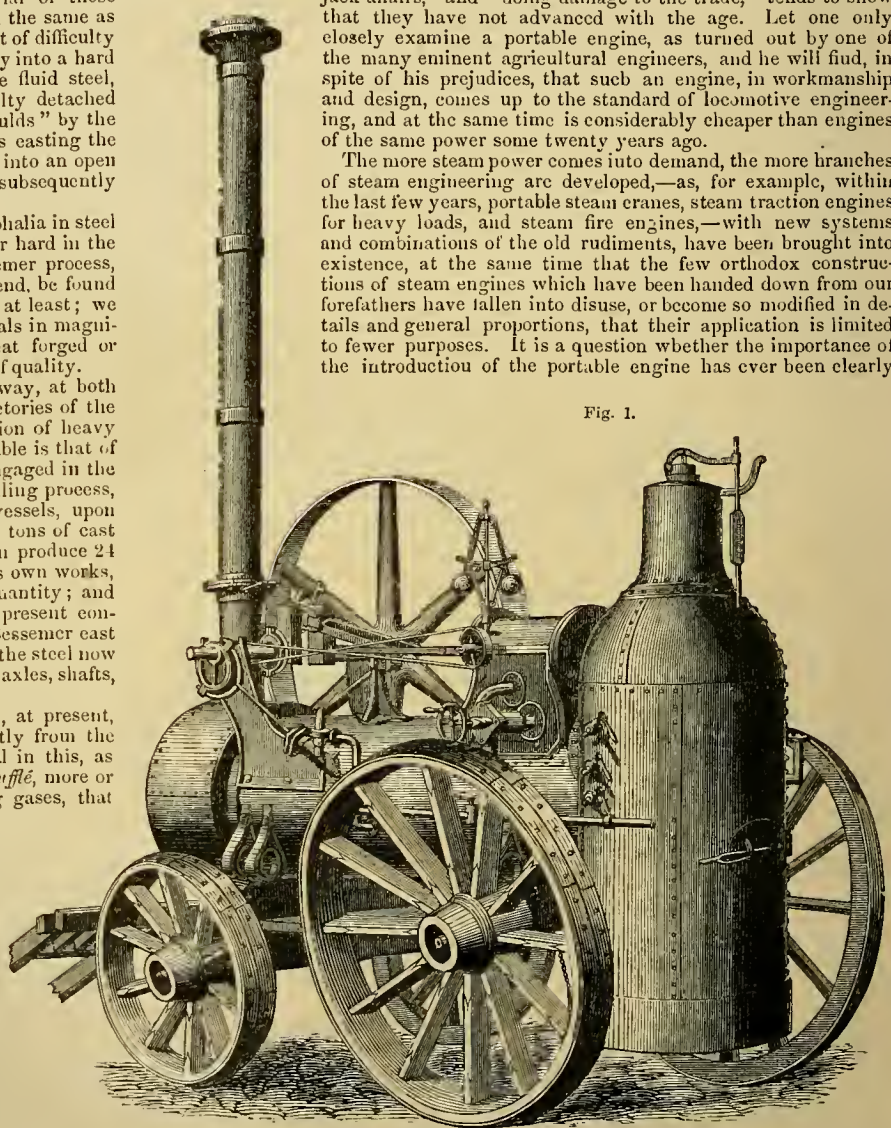
The great day of Sheffield, then, is at hand, if she but use her opportunities wisely, nor suffer "the tide, which, taken at the rise, leads on to fortune," to escape her.—Ed.

THE PORTABLE ENGINE—PAST, PRESENT, AND FUTURE.

It could hardly have entered into the conception of James Watt, and his predecessors in steam engineering, that the costly and cumbrous steam engine of their days would ever be transformed into the cheap, compact, and useful assistant, known as the portable engine, which forms the subject of the present notice. That it would come to this is natural enough, and it is only a step in the right direction; so that, whatever may be said by old-fashioned engineers about "cheap jack affairs," and "doing damage to the trade," tends to show that they have not advanced with the age. Let one only closely examine a portable engine, as turned out by one of the many eminent agricultural engineers, and he will find, in spite of his prejudices, that such an engine, in workmanship and design, comes up to the standard of locomotive engineering, and at the same time is considerably cheaper than engines of the same power some twenty years ago.

The more steam power comes into demand, the more branches of steam engineering are developed,—as, for example, within the last few years, portable steam cranes, steam traction engines for heavy loads, and steam fire engines,—with new systems and combinations of the old rudiments, have been brought into existence, at the same time that the few orthodox constructions of steam engines which have been handed down from our forefathers have fallen into disuse, or become so modified in details and general proportions, that their application is limited to fewer purposes. It is a question whether the importance of the introduction of the portable engine has ever been clearly

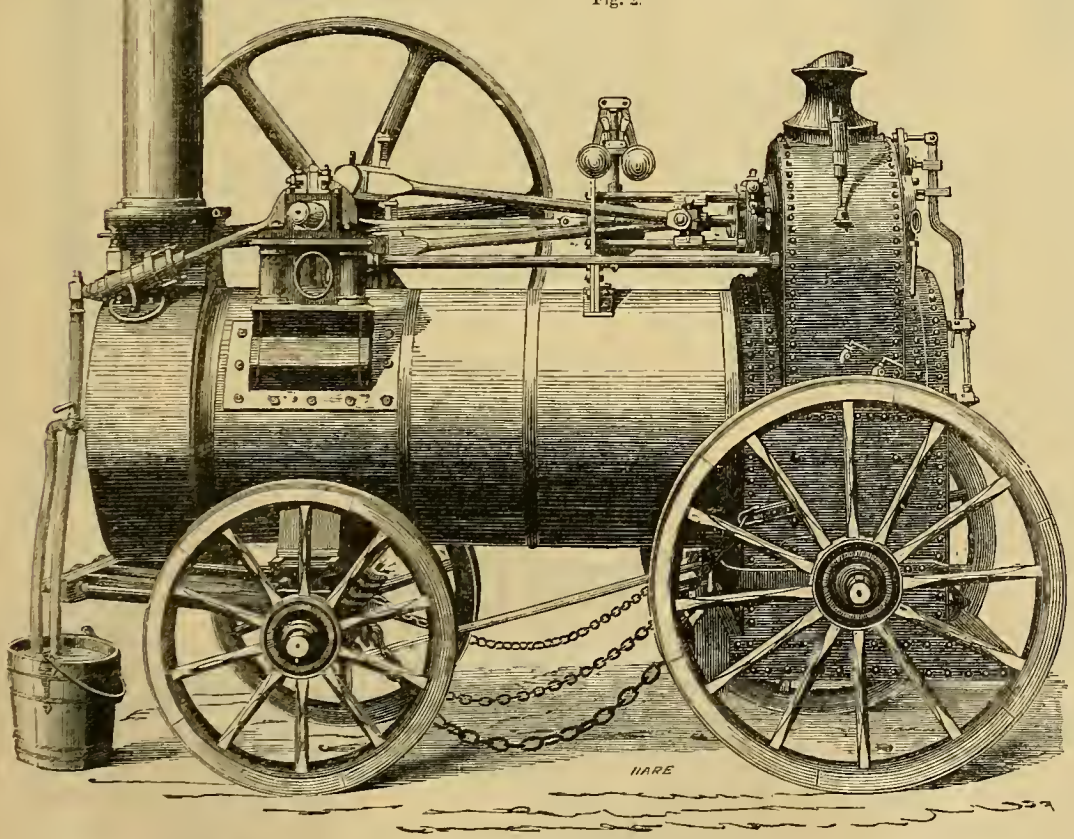
Fig. 1.



understood and duly valued by the public at large. It is daily impressed upon us the enormous advantages steam shipping and locomotion have

introduced into the world; their benefits and convenience are brought under our notice every day; travelling by steam and railway is at least in this country so common, that the phrase of "popular institution" seems hardly strong enough to express its importance and utility. But how many of us are there, who see the portable engine at work, or who know how this handy machine is used and appreciated by the farmer and others? yet there are probably more portable engines in use in this country than locomotives; for it is impossible to get at any approximation of the number in use, because only a few of the largest manufacturers choose to tell the yearly total turned out by them. The time has come when small steam engines, of the portable class and others, are as much an article of necessity and traffic, as that of food or clothing. We have, then, ample reason to take the initiative in bestowing some time and labour on an investigation of the portable engine of the past and present, coupled with some remarks on the probable features of its future. It will not, it is hoped, be without some instruction to the professional and general reader of this *Journal*.

Fig. 2.

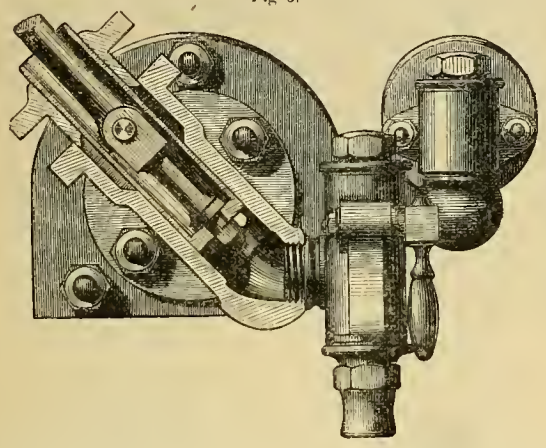


It will hardly be necessary to go into a minute history of the portable engine, tracing it back to "number one" of some maker, whose name is, perhaps, not even known; a critical comparison between the present engine and such as were made some 10 to 15 years ago, will give a good idea of the subject, and be nearly all that is required in the present review. We shall compare them, and by illustrations and data draw some practical conclusions. There was a time when most or all of the agricultural implement makers knew little more of the proper construction of a steam engine than a wheel-wright. He may have had some notions about "heating surface and grate surface," cylinder and crankshaft, etc., and when he had heaped all the necessary parts together on the top of a boiler, the whole concern being probably of very inferior make, he felt satisfied that he had done what was required. He had yet to learn that the farmer knew just nothing at all about it—that he could not, in most instances, afford to keep a highly-paid engine driver, or else the engine did not pay. We cannot wonder, then, at the many accidents which have occurred with these inferior portable engines, when placed in the hand of ignorant farm labourers. To make its introduction general, the maker had to produce quite a different style of engine; everything was required to be simple, strong, and safe, in order that a man with very little knowledge of the steam engine might attend to it. Minute directions, couched in the clearest and most intelligible language, had to be given for the guidance of the engine driver. But above all, he had to alter and re-arrange his establishment to suit it to the execution of work vastly superior to the ordinary range of agricultural implements; he had to seek the assistance of a better paid class of workmen, foremen, and draughtsmen — to rear, as it were, a staff of engineers, to buy machinery of a costly description, in order to save time and labour; and this became the more imperative as the competition between the different makers became stronger, as the usefulness of this class of engine became apparent by the farmer and the general public. When we think of the situation of some of these factories away in the country, near some small market town, with a staff of workmen supplied from village blacksmiths, wheel-wrights, and a few of the useful class of mill-wrights, now almost extinct, we cannot but admire the energy and practical turn of mind of these firms. The impulse given from England spread all over the world in this instance as in numerous others. Wherever corn is produced, land is to be drained, or timber sawn, the English portable engine maker introduces his product; and by studying the requirements of different nations and climes, he competes with native engineers even in highly civilized countries. The question of the advantages and results of the introduction of portable engines to the community at large, does not strictly come within the province of this paper, and is, perhaps, better left to the consideration of the political economist. It is therefore unnecessary to dwell upon the enormous saving effected by superseding manual and animal labour, or to make a calculation of the thousands of acres formerly required for feeding horses, and now used for growing corn, thus enabling the country to support a larger population, and depending less upon importations of corn from foreign countries. In closing these introductory remarks, it will suffice to call attention to one more cause of all these great changes produced by the portable engine. There is no doubt that we owe a great deal to the different agricultural societies here and elsewhere; their shows, trials, and prizes have roused the eager competition of the different makers, and there is no doubt that, but for these, the aspect of things would be very different.

Portable engines 15 years ago, and those now made, may, to the casual observer, not appear to be widely different; but a closer inspection will show us many little improvements which, combined, make a very material difference in their quality of good and useful engines. Fortunately the first portable engine makers, perhaps accidentally, or owing to a proper understanding of the requirements of the case, selected the locomotive boiler as the type, which, modified to suit a lower pressure and slower draught, has proved to accomplish almost all that could be wished in many respects, viz., simplicity, durability, efficiency, and we may add, with due regard to the low price, economy in con-

sumption of fuel. But most of them were built differently from what locomotive and portable boilers look now-a-days. Some had separate steam domes, some cylindrical or semi-cylindrical fire-boxes, the top of the same being either flush with the top of this barrel, or projecting above the same, and terminating in a sphere. No doubt the cylindrical form is the strongest; but for several reasons—principally cheapness in execution and easy access for cleansing—the square fire-box either made flush with the top of the barrel or otherwise, has superseded the former constructions. Then there is one more difference: in many older engines, and with a show of reason retained still by some few makers,

Fig 3.



we find a water space under the grate; the advocates of this construction say, that hereby the sediment gets a free passage to the fire-box under the grate, where it does less harm, and can be blown off, and thus the boiler can be kept clean much longer. They claim a saving in repair resulting from this, which is not unlikely when bad water is used, and blowing off is carelessly attended to; but when fitted with mudholes at the four corners of the fire-box, the removal of the same allows of the sediment being taken out; regular and judicious blowing off also prevents the accumulation of dirt to any great extent. As an example of an old portable engine, the illustrative engraving, fig. 1, is given. It is a side elevation of an engine of six horse power as made by Messrs Hornsby & Sons in 1847. The fire-box is semi-circular below, and ending in a sphere above the barrel of the boiler, with a small circular dome on the top. The main shaft is cranked between two bearings, which was early used by these makers, and is now universally employed It has this advantage over the crank shaft with a single crank fixed to one of its ends, and called "the over-hung crank," that the friction is distributed over two bearings instead of one, and thus prevents one-sided strain on the shaft, and at the same time allows the power to be transmitted from either of its ends, thus affording the arrangement generally adopted of fitting the fly-wheel, which also acts as a large band pulley, on the one end, and a smaller band pulley on the other end. Comparing this old engine with one of Messrs Hornsby and Sons' present make, we find a marked improvement, in nearly every respect, that suggests itself to the engineer. Fig. 2 is a side elevation of an eight horse-power portable engine as now made by that firm. The Messrs Hornsby & Sons have been many years engaged in this trade, and have ever kept among the foremost in it. Their last engines at the recent International Exhibition fully testified to their skill and ability. The general appearance of the engine is pleasing and neat, the workmanship of the first order, and the details well proportioned, simple, and strong; and their present engines, it is known, stand trial as to the consumption of fuel as well as the one exhibited at Paris in 1855, viz., consuming only 3½ lbs. coal per horse-power per hour. The fly-wheel has a counter-weight cast to the rim for balancing the weight of crank and crank end of the connecting rod. It is a pity that so few engineers are alive to the importance of this, especially as it does not involve any extra cost worth mentioning. The cylinder is enclosed in the steam-chest on the top of the fire box, thereby preventing condensation during expansion, and securing purer steam. Why the fire box and steam chest are not felted and woodlagged all round the sides and top, is, however, not easy to understand. Probably this engine would be still more economical if the exhaust steam pipe were carried outside the boiler instead of inside, where it robs the surrounding steam of some heat on its passage to the chimney. The crank-shaft brackets look well, but rather heavy; the brasses in the same are made to tighten up sideways by two screwed wedges. These engines are made with or without separate expansion valve, and the slide eccentrics are constructed so as to be very conveniently adjusted and fixed on the shaft. The guide-bar support might have been made in one piece for the sake of simplicity, instead of, as now, in three or four. The safety-valve is large, and an open cap on the top of it serves as a support to the chimney when it is laid down in its horizontal position. The guide-bars are round, whereby the oil has a tendency to run off, and soil the lagging of the boiler underneath; in this respect the crank-shaft brackets are better off, as they are provided with a dish for collecting the oil which falls down from the bearings. There is a simple contrivance for heating the surplus feed-water, which, as the feed-pump, and very properly so, is constantly kept going when the engine is at work, is returned to the tub through part of the exhaust steam pipe. Fig. 3 is an enlarged sectional elevation of the feed pump, and its suction and discharge valves, with reverse cock; and fig. 4 is a section of the latter at right angles to fig. 3, showing the arrangement of the cock for passing the water through the exhaust pipe, as just described, when the pump is not feeding the boiler. Among other details which are pleasing to the eye, and combine practical utility, we may name the guard on the governor for preventing the balls from striking the spindle or the links, and the little spring for joining the ends of the governor strap, nipping the same with its sharp edges, and serving as a buckle. As to the boiler, it may be remarked that it is well proportioned, the tubes being widely apart, and as much as possible in parallel rows above each other. Covering the opening in the smoke-box leading to the chimney is a sheet of wire gauze,

Fig 4.

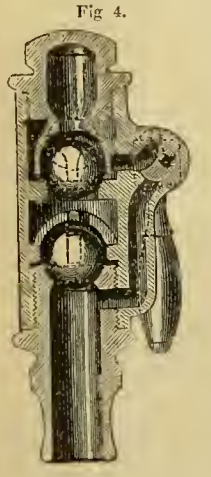
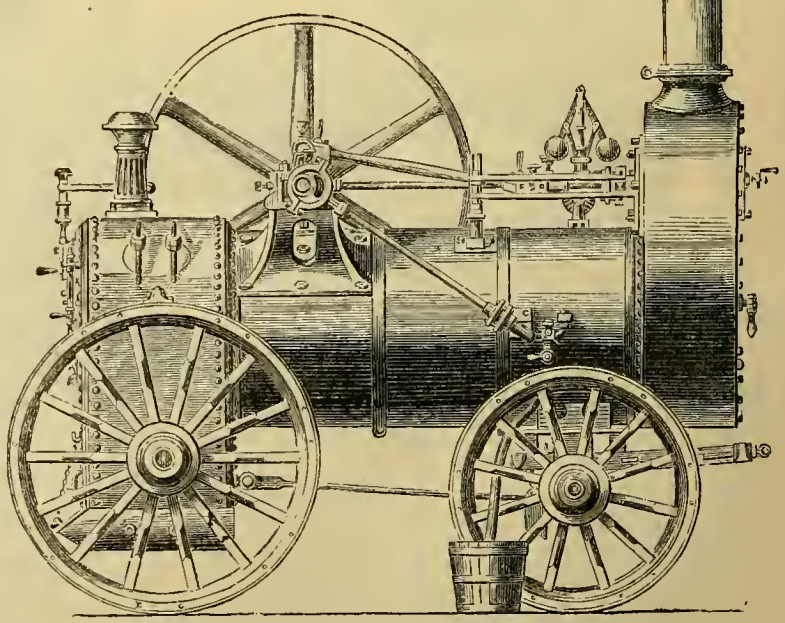


Fig. 5.



serving as a spark arrester, but we cannot speak as to its practical efficiency. A few holes in the fire-door admit air in above the grate, and keep the door cool; the small holes in the burn-plate of the same are, however, too close together. The staying of the fire-box is not over strong; the stays are apparently only ½ in. screws, being 6 in.

apart. The centre of the hind axle is in the centre of the fire-box, and the axle is bent round the inner end of the fire-box, and fastened to that, as well as to the sides, and supported on springs. The crank-shaft brackets are strongly stayed to the flat ends of the steam chest. The weight of an 8 horse-power engine is 58 cwt., without water in the boiler. These engines consume about 3½ to 4 lb. of coal per actual horse-power per hour.

We have been unable to give an illustration of an old portable engine of Messrs Clayton, Shuttleworth, & Co.'s; but we know that the contrast is striking, when comparing that old, clumsy affair with their present engines, well-designed in the whole, as in the smallest details, with a view of easy access and repair everywhere. Fig. 5 is an elevation of their present 8 horse-power engine. It may here be stated that Messrs Clayton, Shuttleworth, & Co., make two sorts; one for common purposes, simpler, and slightly cheaper, but not so economical in combustion of fuel as the other class, which, by having the cylinder enclosed in a steam jacket surrounded by the hot gases in the smoke box, represents a system akin to the "superheating," which of late has been so largely re-introduced in steam engineering. Whether the steam is superheated in the boiler itself, or in the steam jacket round the cylinder, is, after all, the same thing; and the latter arrangement saves a separate apparatus, which, in practice, is often made too large—heating the steam to an injurious extent. The small surface of a cylinder, and the fact of its being of cast-iron—which better resists the influence of high temperatures (perhaps 900° which is seldom exceeded in the smoke box of a portable engine) than wrought iron—seems altogether to be a safeguard against the superheating being carried too far on one hand, and the burning through of the steam jacket on the other hand. To show the amount of saving produced by the introduction of this arrangement, added to minor improvements, we subjoin a table of the performance of these engines at the public trials before the judges of the Agricultural Society of England:—

Year.	Horses Power.	Time getting up steam to 45 lbs. per inch.	Coal used in getting up steam to 45 lbs. per inch	Coal used per H.P. per hour, while doing the work of nominal H.P.
		Minutes.	*Lbs.*	*Lbs.*
1849	5	44	32.25	11.8
.....	7	45	37.75	10.78
.....	9	37	41.25	11 66
1850	7	43	36.5	7.77
1851	6	32	35.4	8 63
1852	6	32½	22.75	6.0
.....	4	41	29 5	8.40
1853	4	47	17.75	4 32
1854	6	39	.....	5 19
1855	8	34	.....	4.05

If the cylinder itself, and not its jacket, as here, were exposed to the direct heat of the escaping gases, as has often been done, no doubt the wearing parts in cylinder would suffer great injury; as it is now, the steam in the jacket is superheated to about 400°, and, on its passage through the slide box and ports, a considerable portion of this heat is probably lost—entering the cylinder at about 350°. It is stated that the present engines (with steam jacket and separate expansion slide) consume about 3½ lbs. of coal per actual horse power per hour, whereas, their engines of the common, exposed cylinder construction, use about 6 lbs. Clayton & Shuttleworth's engines are well proportioned in every respect. The boiler is of the common construction, and well designed, the fire-box strongly stayed; instead of bending the fire-box plate round the fire door hole, as is the common way, a stout ring is riveted round the same between inner and outer fire-box; the injury resulting from mud collecting in the hollow of the joint is thus obviated. The spark catcher is not of the best construction. The details of the engines worthy of special notice are the compact arrangement of the cylinder, with its jacket and slide valves, shown in transverse and horizontal section in figs. 6 and 7. The valves and passages in the feed-pump are rather small; the crank shaft brackets are cast hollow for the larger engines; set screws adjust the bushes of the bearings sideways on the fly-wheel side, and a screwed wedge the bottom brass. The guide-bars for the cross head are of wrought-iron, case-hardened, and the guide-blocks have adjustable cast-iron wearing pieces on the working side, at the top or bottom, as the case may be, or at both when fitted with reversing gear. The wearing parts of the governor are of wrought-iron, case-hardened, or of chilled cast-iron. The bearings for the crank shaft are longer than usual. The guide for the slide rod is very simple, being a brass guide carried on the elongated screw bolts of the stuffing box. There are no stays between the cylinder and crank-shaft brackets; and if these are strong and well fixed, this construction is perhaps preferable to the other, as the longitudinal expansion of the boiler by heat is likely to interfere with the position of the brackets when these are stayed to the cylinder. There is no arrangement for counterbalancing the weight of the crank and adjoining end of the connecting rod. The exhaust pipe is carried inside the boiler, which represents a certain quantity of heat lost for every stroke, however neat it looks. The feed-pipe is accessible for cleaning. The directly loaded safety valve is a very neat little affair. Besides this, there is another safety valve, with spring balance. The starting valve, inside the boiler, with lever, spindle, and handle broken away, for moving it from the end of boiler, is shown in side and end elevation in figs. 8 and 9, as detached. The water plug for filling the boiler is on the man hole, thus doing away with an extra hole in the boiler. Messrs Clayton and Shuttleworth are doing a large and ever-increasing trade in these engines; altogether, they have manufactured 5000 steam engines of various kinds; and whereas they, in 1854, made nearly 400 portable engines, they turned out about 15 a week in May of this year; and at the end of this year they will have manufactured 600 portable engines, besides some stationary engines, within one twelvemonth. The division of labour is carried as far as possible at their factory, and machinery is doing all the work it is possible to do; thus, all parts of the engine, fitting on the circular part of the boiler are planed on a radial bar

Fig. 6.

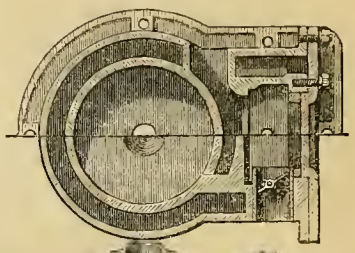


Fig. 7.

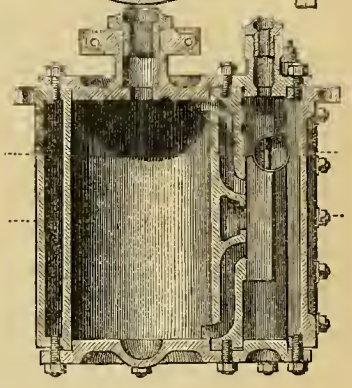


Fig. 8.

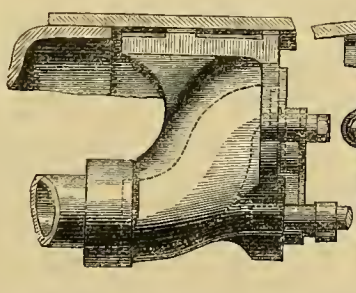
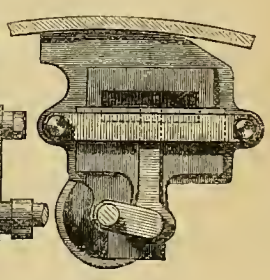


Fig. 9.



planing machine. Messrs Clayton & Shuttleworth always furnish their customers with a little book containing directions for the driver, and such a clear and useful little treatise, on the proper treatment of portable engines, is seldom to be met with. One remark only is open to criticism: the thickness of coal on the fire grate is recommended to be 2 or 3 inches; this may be very good for a low pressure up to 40 lbs., but when the engine works up to 60 or 70, the strong draught is likely to burn holes in the grate, thereby allowing air in large streams to rush in through grate and wasting much heat, if the firing is not very carefully attended to; a layer of 4 or 5 inches is certainly the minimum for 60 lbs. working pressure, the exhaust being about 10 lbs. pressure when cutting off at ⅜ of the stroke. We would also suggest a better mode of packing than recommended in the book, viz., to take the spun yarn in lengths of 6 or 8 inches only, and to force it down with wood, and not with iron, as it spoils the polish of the piston rod. The remarks on cleaning the boiler out frequently are excellent; too much stress cannot be laid upon this point being the means of keeping the boiler, especially about tubes and tube plates, free from leaks and cracks—the serious drawback against the use of tubular boilers of all kind, when perfectly pure water cannot be obtained, or when the boiler is not very carefully attended to; the fact is, that it is a very easy matter to spoil a tubular boiler in one year, whereas, it is possible to keep it in constant use, without leaks or cracks, for four or five years, with proper care. We shall, in our next number, return to this subject.

P. J.

WHEELS OF IRON AND WOOD.

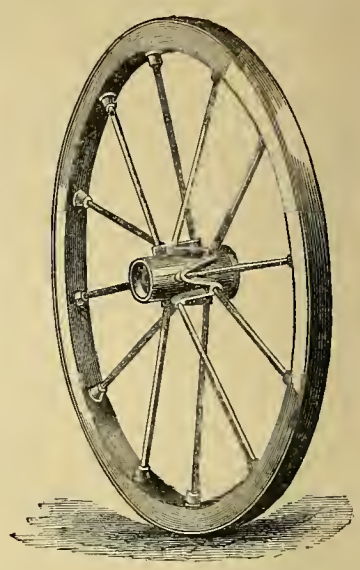
The advance made, from the pristine solid disc of round timber, hewn across the grain, and from the knotted root-wood, which, even still, in some remote regions of Europe, and in many of Asia, forms the wheel of the agriculturist's wain, or the Ryot's hackery, to that framed of nave, spokes, and felloes, was very great. It, probably, was not made all at once to the form and principles of our modern dished wheel. The latter, if we consider what an insistent load it will sustain, what hammering over paving, etc., it can bear, the time it will last, and the excessively small amount of material from which all this work is obtained, is amongst the most beautiful results of human ingenuity. It owes a good deal of its springing resistance to the way in which any force, applied at one point in the plane of the wheel, is transferred in thrusts or pulls, all round the circumference and centre; and partly to the skilful way in which the elasticity of the timber of the spokes is evoked, by a constant limited amount of transverse strain. In short, it is a combination of surprising strength, even transverse to the plane of the wheel; its properties, in this direction, having given rise to its having been employed in barbarous times to secure the struggling wretch when bound and "broken upon the wheel."

As compared with any other construction of wheel that has been devised, for common road carriages, it may be safely stated that the old wood spoked wheel, with shrunk-on tire, still remains the very best, although dozens have been patented, and others invented, but not patented.

But the old wood wheel is expensive, even with the aid for forming it, of all that wood-cutting machinery has, in latter years, effected; and the timber, even of the best quality, rapidly suffers by decay, at some vital points, as a necessary consequence, of its construction; thus, the violent cross strain brought upon the tenoned ends of the spokes, in the mortices of the nave, soon permanently compresses a little, the spoke timber here, especially when swelled by damp weather; the next drought or heat, and the spokes shrink; the mortices become, now, a little too big; water enters, drawn in with power, by capillarity, and then, after a time, the nave, at heart, and the spoke ends, become rotten. The same thing, but less rapidly, happens with the mortices of the spokes in the felloes. These evils have been sought to be radically cured by the substitution of various forms of wheels, wholly of iron. Of these, probably Jones' patent suspension wheel, with wrought or cast iron rim and nave, and wrought iron rod spokes, always under considerable intitial tension, had the most extensive trial. Many of us may remember, in our youth, having seen them under waggons, etc., in considerable numbers, in London streets; and an odd pair may even yet be seen, belonging to some respectable house that entertains the true old tory notions of adherence to whatsoever it has once adopted. The noise and jar of these wheels upon the pavement, however, were abominable; and they sometimes broke in a very sudden and unexpected manner, and have, in fact, had their day. Many attempts have, again, been made to produce a wheel, partly of iron, and partly of wood. Some of the earliest, formed the nave of cast iron, with sockets into which the woods spokes were driven, the felloes and tire being as usual. Here, indeed, the nave no longer rotted; but all the causes operative to their loosening were in exaggerated play, and the spokes themselves became loose, and rattled in the iron naves, and, finally, rotted, and broke off short. This was a Scottish invention, we believe.

More recently, wheels have been produced, with nave and spokes all of iron, and with timber felloes interposed between these and the outer iron tire, which was either laid on in lengths, and bolted through, or, in one ring, and shrunk on; and of this class, there have been many varieties, bad and good. Amongst the former set, we noticed a pair of wheels, upon a small field gun, in the late Exhibition, in which the spokes were made of thin, flat bars, each circumscribing a sector (as in the arms of some railway wheels of old pattern); one end of the bar was secured to the cast iron nave, passing out from it radially, then took the curve of the segment of the periphery, and returned radially, again, back to the nave; each pair of radial bars laying close together, in adjacent sectors, to form one spoke; round the completed circumference of iron spoke sectors, a rim of wood, like a continuous felloe, was placed; this was shod outside, with a shrunk-on iron tire; and the latter was bolted through the felloe wood, to the spoke sector within; the mode of connecting the flat spoke inner ends to the naves, it is not worth describing, as it was even more unmechanical than any other part of this, which may be pronounced the *ne plus ultra* of a *bad* wheel. We may pity the power that should be cajoled, by supposed cheapness, into trusting its field artillery to such means of moving it.

In the Exhibition, but in an altogether different quarter of it, we, however, noticed another form of combined wood and iron wheel, which appears to us the best wood and iron wheel we have seen, and which, although apparently now some time in use, and with, we suppose, some established reputation by time, we do not recollect having ourselves previously seen. This is Mr George Parsons', of Parrett Works, Martock, Somerset, patent wheel, of which we give the annexed engraving. The nave is of cast iron, ribbed in a sort of herring-bone fashion all round, from spoke to spoke, so as to give a form of much strength, without much weight. The spokes are of round wrought iron, and are screwed, or cast into the nave; the outer end of each round spoke is screwed, and has a cast or wrought iron, or other shoulder collar, screwed down over it, leaving the extreme end of the spoke projecting; a timber felloe, which may be in one piece all round to a single lap joint, or might be made in plies of bent asb, or, as in the wheel we saw, in lengths, with butting ends, is bored, at the proper intervals, to receive into auger holes the ends of the iron spokes, passing nearly through the felloe. The iron tire is now shrunk-on (or, might be bolted in laps, but is best, we think, shrunk-on); and when cold, the shoulder collars are screwed up outwards from the centre, upon each spoke, until all are set up hard against the timber, at the interior edge of the felloe. Of course, some water-resisting stuff, like white lead in oil, or the like, may be placed beneath each collar before being so screwed up. Now, here is an extremely easily and cheaply made, and an extremely strong and very durable wheel. They are sold cheaply, it would seem too, for, on the price list, pasted over the wheels, we saw that a pair, to carry 1 ton, on 2 in. axles, 4½ ft. diam., with a tire $3'' \times \frac{1}{2}$, was priced £5; and a pair to carry 3 tons, 5 ft. diam., $5'' \times \frac{7}{8}''$ tire, was £11 7s.



Constructively, we consider this the best combined iron and wood wheel we have seen. Several slight modifications in the detail of construction are conceivable, and, perhaps, in one or two points might, even still, further improve it; but, precisely as it is made, and as it was exhibited, it is an excellent result of practical skill; and we are much mistaken, if it prove not so in actual use.—En.

RANSOME'S PATENT CONCRETE STONE, MADE WITHOUT BURNING.

At the Cambridge meeting of the British Association, Dr Ansted made a communication to the mechanical section upon this material, of which a report appears in another column. The following is a summary of the points of chief interest. Mr Ransome many years since obtained a patent for the production of artificial sandstones, by baking various combinations of lime, alumina, and silex in the state of sand, after having been heated with alkaline silicates in solution, and the material resulting was extremely beautiful.

His much more recent patent rests upon the fact, the discovery of which is, we believe, due to himself, that, by the like process, without any baking, but by a play of double decomposition, at common temperature, a hard and durable silicate may be obtained.

NATURE OF THE MATERIAL.

This material, which is essentially different to any other that has yet been artificially produced, and which can be produced in blocks or forms of any required dimensions, is suitable not only for the construction of solid masonry, but also for the manufacture of the most elaborate and delicate architectural embellishments.

It is composed of ordinary sand, chalk, or other mineral substance, firmly aggregated and cemented into a solid, hard, and indestructible mass by means of a silicious cementing material, which by a subsequent simple operation is converted into an insoluble silicate of lime, possessing all the enduring properties of the old Roman concretes or mortars, which have remained unchanged during a period of two thousand years.

PROCESS OF MANUFACTURE.

The process of manufacture is simple, and based upon scientific principles. The sand, chalk, or other mineral substance is intimately mixed with its proper proportion of a solution of silicate of soda. This is effected by an ordinary pug mill, and the mixture which is thus rendered of a plastic consistence is either pressed into blocks or moulds, or can be rolled into slabs or such forms as may be desired, and is afterwards either saturated with, or immersed in, a solution of chloride of calcium, when a

double decomposition of the two solutions employed (viz. of the silicate of soda and of the chloride of calcium) takes place. The silica combines with the calcium, and at once forms an insoluble SILICATE OF LIME, firmly enveloping and cementing together, all the particles of sand chalk, or other mineral of which the stone is composed, whilst the chlorine combines with the soda and forms chloride of sodium which is removed by subsequent washing.

COST OF PRODUCTION.

The cost of production in plain blocks or slabs is less than that at which natural stone can in many places be obtained, whilst for mouldings or other ornamental work, the additional labour in working the material is so trifling as scarcely to require notice; the principal item of expense in such work is the preparation of the necessary moulds, but as these may be made either of wood or plaster of Paris, they need by no means be costly, and where a repetition of the same article to any considerable extent is required, the proportionate cost of the mould chargeable upon each article would be inappreciable.

Amongst the advantages offered by the process, may be noticed:—

1st. The manufacture is simple and inexpensive, requiring no large amount of outlay, or of plant, &c.

2nd. The materials employed are for the most part of the commonest productions of natnre, and abound in most localities.

3d. The stone can be manufactured where it is required to be used, and of the exact form needed, and this too at a smaller cost than natural free stone conld be supplied anywhere in a wrought state, or frequently even in the rough.

It is equally applicable for solid constructive masonry, and for elaborate embellishments. In appearance and texture it closely resembles some of the best descriptions of our natural stones, and it can be prodnced of any desired tone of colour.

4th. No waste is incurred in the manufacture, and where desirable, in order to lessen the cost of carriage, the stones can be made hollow as readily as solid.

5th. Whilst most of our natural building stones are rapidly acted upon by acid vapours and the atmosphere, particularly in the manufacturing districts, and in populous towns, to such an extent as to prodnce disfiguration and decay in a comparatively short period, this is not only unaffected by such influences, but gradually increases in hardness with the lapse of time; and the opinion expressed by one of our most eminent chemists is, that "it is a material which, with the exception of the primary rocks, is better capable of giving permanency to external architectural decorations than any stone hitherto used."

6th. In point of strength the "Patent Concrete Stone" has been proved snperior to Portland Stone.

TRANSVERSE STRENGTH AND COHESIVE POWER.

The following results were obtained in a series of experiments which were reported upon by Professor Ansted, in a paper read by him at the recent meeting of the British Association held at Cambridge.

The Transverse Strength was tested in the following manner:—

	lbs.
A parallel bar, measuring 4 ins. × 4 ins., and resting upon iron frames, so as to bear 1 inch on the iron at each end, with 16 inches clear between the supports, sustained a weight from the centre of.....	2122
Whilst a bar of Portland stone of the same dimensions, and treated similarly, broke with.....	795½

The Cohesive Power was proved upon pieces of stone notched for the purpose; the sectional area of which at the weakest part was 5½ square inches:—

The specimen of Ransome's concrete stone sustained.....	1,980
Whilst Portland stone, of same dimensions, and treated similarly, broke at	1,104
Bath do. do. do. do.	796
Caen do. do. do. do.	769

A 4 inch cube of Ransome's concrete stone was found to sustain a weight of 30 tons before it was crushed.

EXTRACT FROM REPORT OF DR E. FRANKLAND, F.R.S.

December, 1861.

I have submitted to experimental investigation the samples of stone forwarded to this laboratory, and have now to report as follows:—

The experiments were made in the following manner. The samples were cut as nearly as possible of the same size and shape, and were well brushed with a hard brush. Each sample was then thoroughly dried at 212°, weighed, partially immersed in water until saturated, and again weighed; the porosity or absorptive power of the stone was thus determined. It was then suspended for 48 hours in a very large volume of each of the following acid solutions, the alteration in weight after each immersion being separately estimated.

The sample was then boiled with water until all acid was removed, and again weighed. Finally, it was dried at 212°, brushed with a hard brush, and the total degradation or loss since the first brushing was ascertained. The following numbers were obtained:—

Name of Stone.	Porosity. Per cent. of water absorbed by dry stone.	Per centage alteration in weight by immersion in dilute acid.						Total per cent. loss by action of acid and subsequent boil. in water.	Further loss by brushing.	Total degradation from all causes.
		Of 1 per cent.		Of 2 per cent.		Of 4 per cent.				
		Loss	Gain	Loss	Gain	Loss	Gain			
Bath	11.57	1.28	—	2.82	—	2 05	—	5.91	.26	6.17
Caen	9.86	2.13	—	4.80	—	.67	—	11.73	1.60	13.33
Aubigny	4.15	1.18	—	4.00	—	—	1 04	3.56	.29	3.85
Portland	8.86	1 60	—	1.10	—	1 35	—	3.94	.24	4.18
Anston	6.09	3 52	—	3.39	—	3.11	—	11.11	.27	11.38
Whitby	8.41	1.07	—	—	.53	none	none	1.25	.18	1.43
Hare Hill	4.31	.75	—	—	.60	none	none	.98	.15	1.13
Park Spring	4.15	.71	—	—	.10	.15	—	.81	none	.81
Ransome's Patent	6.53	—	.95	none	none	none	none	.63	.31	.94

The numbers in the above table speak for themselves, and it is scarcely necessary for me to add, that whilst they point out the Portland, Whitby, Hare Hill, and Park Spring, as the natural stones best adapted to withstand the influences of town atmospheres, they also indicate that Ransome's patent concrete will be found equal to the best of these, and if the newness of Ransome's stone (the specimen experimented upon not having been made a fortnight) be taken into consideration, together with the well known fact that its binding material, silicate of lime, becomes harder, and more crystalline by age, I am induced to believe that Mr Ransome has invented a material, which, with the exception of the primary rocks, is better capable of giving permanency to external architectural decorations than any stone hitherto used. There is nothing in the composition of the stone which would lead me to anticipate that it would suffer from exposure to the saline influences of the atmosphere upon the sea coast.

(Signed) E. FRANKLAND.

FREDK. RANSOME, Esq.

SOLID DRAWN GUN BARRELS.

ON the 1st December, 1862, by the permission of the Court of the Gunmaker's Company, some very interesting experiments were made at the proof-house, Whitechapel, London, on a fowling piece and rifle barrel made by the new process of solid cold-drawing, of which Messrs Christoph, Harding, and Hawksworth, are the patentees. By this process the metal is drawn cold, by means of the hydrostatic press, and thus a saving is effected to the extent of one-half the metal now consumed by the hot process. For instance, about 10lb. of metal is now used in making an Enfield rifle barrel, which, when made, weighs only 4¾lb., the remainder of the metal being consumed in the manufacture. By the present process two rifle barrels can be drawn from the same amount of metal, equally strong in every respect to those now made. The barrels tried were drawn from a new kind of cast steel, and subjected to the following proofs:—

Rifle Barrel.

First proof.....	7½ drachms of powder 2 wads 1 ball of 520 grains.....	No injury.
Second	Same powder 2 balls.....	Ditto.
Third	10 drachms of powder 3 balls.....	Ditto.
Fourth	15 drachms of powder 5 balls.....	Ditto.

The smooth bore was put to the following proofs:—

First proof.....	10¾ drachms of powder 2 wads One round ball of 24 to the pound.....	No effect.
Second	Same powder 2 wads 2 round balls.....	No effect.

It was then determined to burst this barrel by putting in a proof charge and two balls, and filling the muzzle of the barrel to the extent of two inches with moist clay. The result was, that the barrel burst at the bottom of the clay, only tearing about two inches of its length, and showing no other signs of injury. A similar barrel, proved

at Birmingham, only slightly bulged, with 20 drachms of powder and 3 balls.

Several specimens were also exhibited, showing the applicability of this process to drawing hollow tubes in iron or steel of any shape, and almost any reasonable length. At present we understand it has not been applied to tubes of more than 1⅜ inch diameter, or to a length exceeding 30 feet. Its extension to larger tubes is evidently a mere question of mechanical power. The patentees estimate that by the adoption of their process the cost of iron gun barrels will be reduced to one-third the present price, and that a cast steel barrel can be supplied at the present cost of an iron one."

That a very great increase of cohesive strength *in the longitudinal direction* is produced by the forcible extension, either by rolling or by drawing (and whether cold or hot,) wrought iron, has long been known.

In the case of fine iron wire, such as pianoforte strings, the increase of ultimate longitudinal strength is quite surprising, being as much frequently as an increase of from 30 tons per square inch ultimate strength in the original forged or rolled slab from which the wire is to be drawn, up to 120 tons per square inch in the wire itself. The nature of the molecular changes produced by this powerful compression laterally and extension longitudinally of the crystals of the iron has been pointed out by Mr Mallet, in his work on the Physical Properties of the Metals for Artillery, &c., and shown to result from his law—"That in all crystallizable solids the principal axes of symmetry of the integrant crystals, tend to place themselves at right angles to the direction of greatest pressures within the mass"—which is in a drawn or rolled rod longitudinally, *i.e.*, at right angles to the pinch of the draw-plate or rolls. It is in virtue of this that the hot rolled rod of rivet iron, is stronger and tougher longitudinally than the lump out of which it is rolled, and if a piece of this hot rolled rivet rod, be cut off, and drawn out into fine wire, its strength and toughness will be still further exalted.

If the rod be rolled cold, the same result proportionally to the pressure and mass follows. This effect of cold rolling on iron was announced some few years since as quite a new discovery, and Mr Fairbairn made some experiments on the increase of strength conferred. If the bar or the wire be heated red hot however, and cooled suddenly, or be slowly annealed, though some increase of strength remains, a great deal of the increased strength is found again to have been lost.

There is no doubt whatever that a cold drawn gun barrel, therefore, will have a very high amount of longitudinal strength, but it by no means follows that any like increase of strength as against bursting by the charge of powder, through circumferential strains, or any increase *at all*, as respects this, shall result.

If a rod forged in a twisted set of spirals like a twist barrel, were drawn or rolled cold, and after its extension would bear further forcible cold twisting in the same direction, we think it not improbable that some increment of strength as against bursting might be obtained, though we say this with reserve; but if so, this would not survive the rods being annealed. Any rod or barrel thus treated, or drawn or rolled cold, has its particles thrown into tensions and internal strains, which, at every particle cut off, either from the outside or the inside, by filing or boring, &c., will cause the whole mass to alter its shape by twisting or bending spontaneously. In fact, this actually takes place now in the Enfield forged barrels inevitably, to a sufficient extent, to make final straightening by the hammer necessary. Of course, the same may be done with cold drawn barrels, but the internal strains will be far more vehement, and we apprehend such barrels might show a persistent tendency to return to a crooked form.

However, the method presents other advantages in point of economy, &c., which are in no way problematical; and we should be greatly pleased to see some really well-devised experiments made by water pressure, upon cold drawn and upon hot rolled barrels from the same iron, as to their relative bursting resistances, a question which, certainly, the preceding experiments do not solve.

Our remarks are not meant as condemnatory of the proposed method, nor even as discouraging, we but wish to place in contact with what is proposed, the ascertained facts of metallurgy already known.—Ed.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

THE CATTLE AND IMPLEMENT SHOW OF 1862.

This year, the Royal Agricultural Society, for the first time, displays its means, its methods, and its results, in its new quarters, the Agricultural Hall, Islington.

The change from the Baker Street Bazaar is greatly to its advantage. Nothing can be more admirably adapted for these displays, demanding so much room, and freedom of ventilation, with facility of access, than this fine new building. The front to the road presents a fairly balanced, we might almost say a striking façade, in parti-coloured brick, in which the surfaces are not too much cut up, nor made bizzarre by violent and unsettled contrasts, as is too often the case, when, as in this instance, something of a Byzanto-Romanesque style has been employed. The highest outlines, or, as they are called "the sky lines," are extremely good, and the general effect harmonious.

The interior consists of a vast central parallelogram, of about 400 by perhaps 100, spanned by a well-executed wrought iron curvilinear girder, or apparent arched, roof, resting on cast iron columns, with bars and capitals in some degree borrowed from those of the Paddington Station, but better proportioned, and coupled in the direction transverse to the length way of the roof, to a rere range of columns, by cast iron framing that shows itself, as does, indeed, equally the general structure of the whole of the iron part of the edifice, to have resulted from a study of the Parisian Exhibition Building of 1855. The segmental gables at both ends are plainly and handsomely glazed in, vertically.

About half the surface of the segmental roofing is glazed, with a central continuous raised skylight, with continuous louvres for ventilation at both sides. The opaque part of the roofing appears to be covered with slating, and rendered smooth by cement or plaster interiorly, so far as we could judge. This large roof, which has very much of the character of the new curvilinear roofing being erected at the Pimlico Railway Station, is in some of its details heavy and over metalled, and does not indicate the proportionising of one habituated to the calculations of stress and strain in iron; and is in some respects, as for example, in the useless diagonal tye rods that deform it, by entangling, as in a net, the lower webs of the arched girders, loaded with unnecessary parts; but though not incapable of being found fault with, there is much in its general character to praise, and the effect of the whole is very noble. The great central space is surrounded on all four quarters, *i.e.*, sides and ends, by an aisle, in two stories, roofed by iron-framed and wood-sheeted and slated roofing, of about half the span of the central area. The roof of this, which is at the level of the springing of the arched roof, may probably be 35 feet, or so, from the ground, and at rather more than mid height, is the continuous and spacious gallery floor, lighted by continuous skylights in its own roof, and looking out between every bay of columns in front, into the great central area, as into a fine amphitheatre. Broad flights of steps of oak on cast iron risers and frames, approach the galleries from the floor beneath, which is of concrete, but not completed as yet. There are no surrounding buildings external to this encircling aisle, except ladies' rooms, a large Refreshment Room, offices of many sorts, including abundance of urinals, and a good set of rooms for the meetings of the Smithfield Club. Indeed, for the matter of Refreshment, one was met at each turn by some such means, to renovate the inner man, to which the appetites brought up from the breath of the breezy field, by those whose ruddy cheeks told that they were not Londoners, appeared to be doing ample justice.

A Post-Office and Telegraph Station, a Reading Room, Veterinary Surgeon's Office, Clerks, and District Officers, and several others, indicate how well the needs of the Agricultural Show have been pre-considered and provided for. The flat interior surfaces of the roofing, are left white at present, and the roof framing is painted a plain, rich purple chocolate brown; and although all having the aspect of being yet incomplete, and the brick of the walls inside still bare and unpointed even, the internal effect is very noble indeed; and presents a most favourable contrast in architectural taste and good proportion, to its pretentious and huge predecessor of the Fowkean order of Brompton.

Along the great central area were arranged, in several rows, the horned cattle, and at both sides, the sheep, the latter in pens of wrought iron very nicely designed indeed. In a separate building, extending endways, outside and beyond the end gallery remote from the front entrance (we should have said there are several entrances and exits), were placed the hogs, and all the Porcine tribe, in temporary wooden pens, a wise arrangement, and one that avoids the odour of these, at best, unsavoury animals, that used to penetrate Baker Street everywhere.

The Islington building was throughout, as free from evil smells—thanks to its ample and well-devised ventilation—as the pleasantest country cow-house could be. All round on the floor level beneath the galleries, and upon the floors of the latter, were arranged the countless implements, from the heavy traction engine and steam plough, to the milk ganges and thermometers of Negretti & Zambra; that are at once both the cause and the effect of agriculture having become from being not so long ago one of the least intellectual of human occupations, though its oldest, one of the noblest examples of the complex applications of science.

There appears to exist a rapidly growing feeling in favour of steam power, for farm purposes, judging from the large display of portable and other engines, from the tiny 1 H.P., for barn work, up to the massive 12 H.P. portable engines, for steam cultivation. We are also glad to observe the increase in traction engines this year. Following the order of the catalogue, (for, at last, the club has considered it necessary to publish one for implements,) we commence with Messrs Tuxford and

Sons' excellent display of engines, for which this firm are now celebrated. They exhibited a 10 H.P. steeple engine, a 3 H.P. horizontal portable engine, and 2 H P. ditto. R. Garrett & Sons are well represented by a 10 H.P. portable engine, and a second of 3 H.P., with a fixed horizontal engine of the same power, all good specimens of workmanship and general arrangement; hut, for portable engines, we prefer that of Tuxford & Sons.

William Tasker & Sons exhibit their patent windlass, with 1400 yards of wire rope, for steam cultivation, already illustrated by us in a former number. This is the neatest and most compact arrangement of windlass we have seen. At Burgess & Key's stand, we have a distinguished visitor from South Kensington, M'Cormick's sheaf delivery reaper, illustrated in the pages of our *Record*. This firm is justly celebrated for reapers and mowers, and have a goodly show of them. John Fowler exhibits his renowned steam ploughing appliances, in the shape of a powerful steam engine, and a four furrow balance plough and cultivator, which are specimens of good work. A new implement is exhibited by A. & E. Crosskill, called the Victoria reaping machine, which is provided with self-acting rakes, revolving in a nearly horizontal plane, but made to rise and fall, as they rotate, by passing over a cam surface, which admits of each rake sweeping over the platform, and removing the corn, and then rising clear again, and held up till it again comes round to the platform. This strikes us as being a much less complicated arrangement of self-rake than that of M'Cormick's. Clayton, Shuttleworth & Co. have a larger show than almost any other two exhibitors together, and monopolise the greater portion of one end of the hall. Their display comprises no less than eight portable engines, from 4 H.P. up to 12 H.P., all turned out in the style for which this firm is noted. They have also four fixed engines, from 4 to 20 H.P., and five combined thrashing machines, variously adapted to the requirements of small occupations in hilly districts and of large farms. Their other articles consist of mill stones, corn mills, straw elevators, dressing machines, saw benches, pumps, etc., etc., indeed, all that a large scientific farmer can want is displayed here. We notice two of Underhill's patent corn elevators, exhibited by the inventor. These elevators are well adapted to their work, and are taking largely with our best houses. Walder & Walder exhibit some wire corn screens. These screens are made entirely by machinery, and are not only stronger and more durable than the ordinary wire lapped screens, but are about twenty-five per cent. cheaper. The wire is wound in a spiral form upon longitudinal supporting bars, fixed at intervals in cast iron rings. Each coil drops into a notch or nick cut in the several bars; and when the coiling is complete, a few taps of a riveting hammer upon the surface of the bars effectually rivets each coil with its notch, the whole forming an exceedingly durable screen. Two noble traction engines (one from the Exhibition) are exhibited by Aaveling & Porter. These are now well known. Coleman & Sons, of Chelmsford, exhibit a 10 H.P. steam cultivating engine, with the windlass attached to the boiler, which we don't like. The steering apparatus is a modification of the ship's wheel and tiller.

A large three horse reaping machine, upwards of eight feet wide, is exhibited by the trustees of W. Crosskill, in company with their well known clod crusher and prize carts. Ransomes & Sons have their usual large assortment of root and chaff cutters, oil cake breakers, and corn mills. The display here is of a more varied character, perhaps, than that of any other exhibitor, comprising seven portable steam engines, ranging from 10 H.P. downwards, horse gears, ploughs of all kinds (double and single furrows), scarifiers, and hoes.

D. W. Childs & Co. have a number of washing machines, clothes wringers, and starchers, and folding revolving dryers—all very useful articles, no doubt, in their way, but scarcely suited for an agricultural show.

Roots and cereals are well represented by the magnificent displays of Thomas Gibbs & Co, George Gibbs & Co., who, by the way, have exhibited no little taste in the fitting up of their extensive stand, Page & Toogood, and Messrs Sutton & Sons, of Reading.

A well-made, large-sized, meat chopping and mincing machine is exhibited by John Gardener, of Birmingham; the chopping knives have a rapid vertical reciprocatory motion imparted to them over a slowly revolving chopping block, which is fitted with a raised metal edge or rim, for the purpose of preventing the escape of the substance under treatment. The absence of noise is a great desideratum in this machine. Mr Robt. Chandler exhibits a complete set of well-made models of his admirably arranged steam cultivating machinery. We noticed a novelty in the shape of a small but powerful crushing mill, for guano, cement, etc., exhibited by the inventor, Mr James House, of Market, Lavington, Wilts. This useful invention, which has only just been specified, consists in the employment of a pair of crushing rolls, having a series of annular V-grooves and projections formed thereon, the projections on the one roller working within the grooves of the other, and both are driven at different speeds. By this machine, we have seen the hardest flint stones, and even clinkers, crushed, with the greatest ease, to a comparatively fine powder—a pretty fair test of what it *can* do, if required. B. Samuelson & Co. have a large display of reaping and mowing machines, both self-raking and otherwise; we were much pleased with their self-acting reaping machine. We find the usual display of brick and tile making machines at the stands of Henry Clayton and Co., and Messrs Page. Having no catalogue in former years, we know not the average number of exhibitors; but, for future reference, as a datum point, we may record that on this the first exhibition at the Agricultural Hall, we find no less than 161 exhibitors of farming and other implements, embodied in an octavo catalogue of 48 pages, and we look for that further development which we fully expect in future exhibitions.

Passing carefully round the whole circture of gallery above and below, it did not strike us that there was anything exhibited amongst the implements or instruments, or amongst the products, of roots, cereals, seeds, &c., to be remarked as strikingly new; but, since last year's show, and even since the time last spring, when so many like objects were deposited in the building at South Kensington, the constant tendency to improvement in the structural details of all the more important and ponderous machines is evident to a mechanical eye. All our old acquaintances nearly, whose names are as familiar to us as household words now, and of whose names, we are proud, as every true Englishman is of the whole Smithfield Club and of its annual display, were there—agricultural engines in many sizes and forms, some finished almost as well as locomotives; the steam plough and the reaping machine, in the half dozen of their most important (breeds, shall we say?) systems; the great brick and tile machines were there; and in the ruck, slicing, chopping, cutting, breaking, crushing, mincing, boiling, steaming, washing, wringing, mangling, weighing, hoisting, packing, steeping, seasoning, physicking, and what not, hundred other classes, of labour saving or better doing machinery.

A wondrous sight, though year after year repeated, to every reflecting man, whose information enables him to grasp conception, of the prodigious mass of mind and science that have evolved it, and has imagination and heart to discern the blessings it foreshadows for generations of men yet to come.—En.

ARMSTRONG AND WHITWORTH GUNS.

ATTEMPT TO TEST ARMSTRONG FIELD BATTERIES IN QUICK FIRING.

The I and K batteries of Field Artillery stationed at Hilsea, near Portsmouth, 25th Nov. 1862, paraded on Southsea common, between Southsea Castle and Lumps Fort, on the line of seabeach, to test their guns, according to an order issued from head-quarters, in consequence of certain reports which had been made to his Royal Highness the Commander in-Chief, relative to the efficiency of the Armstrong gun as the field artillery of the British army. The two batteries arrived on the beach eastward of Southsea Castle at 10.30 a.m., under the command of Lieutenant-Colonel Shakspeare, commanding the K battery, and Captain Martin, commanding the I battery, each battery consisting of six 12-pounders, Armstrong's. The two batteries were under the command of Colonel Anderson, C.B., and each gun was supplied with 120 rounds of shell. A number of military officers were present at the firing, including, with other members of the Select Ordnance Committee, Major-Gen. St. George, Capt. Dyer, Inspector of Ordnance; and Col. Bingham, R A.; and numerous other officers, military and naval. The two batteries were in position on the line of beach by 10 30 a.m., and shortly afterwards the officers specially appointed to superintend the firing arrived on the ground. At about five minutes to 11 a.m. the practice commenced from the guns at 1,700 yards with shell, fitted with "time" and "concussion" fuzes. Twenty-five rounds were fired from each of the 12 guns in 25 minutes, when a pause of 10 minutes took place, owing to a schooner being towed across the line of fire in the direction of Langston harbour. In ten minutes the fire was recommenced, which only lasted 11 minutes, owing to another vessel sailing across the range. Eighteen minutes' delay took place in this instance, after which the firing was continued until the ammunition of each gun was expended, except in one instance, where the gun was disabled. The firing ceased at 1.15 p.m. In the 50th round of No. 6 gun of K battery, the vent-piece was blown out, and buried itself in the ground. In the eighth round, afterwards, this same gun became disabled from a strain in the screw, or some other displacement of parts in the breech. The intervals between the firing, caused by the passing of vessels across the line of fire, considerably diminish the value of the day's firing as testing the lasting powers and efficiency of guns under a rapid fire, inasmuch as the guns had two periods of cooling, and therefore the number of rounds fired had no correct bearing upon the point at issue. The firing throughout could not have been considered rapid—that is to say, beyond ordinary practice, and therefore, whatever may be the report of the officers appointed to conduct the trial, every point was in favour of displaying the best qualities of the Armstrong 12-pounder—the acknowledged best specimen of the breech-loading Armstrong

gun. At the conclusion of the practice from the 12-pounders Major-Gen. St. George, Col. Bingham, Col. Warde, Capt. Dyer, and other officers proceeded to Lumps Fort, where three shots each were fired from two 110 pounder Armstrong guns, but the efficiency of the guns was in no other way tested as breech-loading ordnance. The practice made throughout was good, but numerous instances are alleged to have occurred where the shells burst half way to the target, and some close to the muzzle of the gun, while there were many illustrations of "stripping" of the zinc coating. There was also great difficulty experienced in getting the screws home against the back of the vent pieces towards the close of the firing.

COLLIERY EXPLOSIONS,—USE OF GUN-COTTON IN UNDERGROUND BLASTING.

All the horrors of the Hartley catastrophe have been brought to our remembrance through a fearful explosion of gas which occurred in Walker Colliery, three miles from Newcastle-on-Tyne, about 6 o'clock on the morning of the 22d Nov., 1862, by which 16 men and lads have lost their lives. Walker Colliery is among one of the oldest in the coal trade, having been at work nearly a century, and is about the last of the old famous Wallsend collieries working—all the others having been drowned out. It has two pits, the "Anu" and the "Jane," the shafts being about a quarter of a mile apart, and their depth 160 fathoms. The shaft of the Jane pit has only been re-opened about nine months, after being widened and enlarged, and the coals are brought to bank by that shaft, which is downcast. The seam which the colliery is working is not the old household coal seam, which has made Wallsend famous all over the world, but the low seam; the coal taken from it being used principally for manufacturing and steam purposes. To-day was "pay" Saturday at the pit, and the pitmen were not employed in the mine; it was laid off, and preparations had been made for a large Sunday-school tea-party, to be held to-night. It is usual, however, when the pit is laid off, for the shifters, stonemen, and others to "red it" up, as it is termed, doing any odd jobs in the air-ways, and other parts of the workings; in fact, to put it in good order for the men resuming work on the Monday morning. Between 20 and 30 men and lads employed about the pit in this way had gone down about 2 o'clock; and, so far as can be at present ascertained, the explosion occurred between half-past 5 and 6 o'clock this morning. Two banksmen, named Charles Robson and Joseph Richardson, heard the sound of a tremendous rush of air up the working shaft of the colliery where they were stationed, and on looking in that direction they observed steam and a cloud of fragments flying from the pit's mouth. They informed Charles Cooper, the engine-wright, of the fact, and the alarm that an explosion had occurred spread to the village. Before 7 o'clock three men were brought up at the up-east shaft. They were named Chambers, Knox, and Collins. They were all alive, but each was suffering from the effects of gas and fright, as well as from the shock they had received by being thrown down when the explosion occurred. From their statements, it seems that there would be 25 men in the pit, some of whom were working "in bye," at a considerable distance from the mouths of the shafts. It is supposed that some of these men had been at work in a "trouble," and had fired shots, from which the explosion may have occurred. The injured men were taken home, and were attended by Dr Richardson, who reports that all who had come up alive are likely to recover. They describe the first warning they had of the explosion as like the sound of a hurricane, and its effect on themselves was to throw them violently down. The stoppings, brattices, &c., in the colliery workings are all destroyed, and the mine is thrown into confusion. Mr Cole, the resident viewer, was among the first to descend the pit. Mr Jobling, the principal engineer, and one of the owners of the colliery (which is the property of Messrs Lambert, Nicholson, and Co.), Mr Matthias Dunn, Inspector of Coal Mines, and Mr Potter, of Cramlington, mining engineer, have been down the pit. Those who have walked as far in the workings as they possibly could had seen three dead bodies, and it is feared that several others had shared the fate of their unfortunate comrades.

Down to 6 o'clock to-night six bodies had been found. They were all badly burnt, and had died from the effects of the explosion, and not of the after-damp. They were brought up to bank some time afterwards.

The miners who descended to explore the mine came up much exhausted, and stated the air to be very bad. All the horses, nine in number, and 21 ponies, are killed.

From the nature of their employment, the men and lads who are killed would be scattered about the pit when the explosion occurred, and that it was violent and sharp may be inferred by the fact that the bodies which have been found were lying not far from the shaft, and that a portion of the seam of coal was set on fire. An exploring party who went down the pit this afternoon reported that they found a collyman dead, very much charred, and lying to the north of the shaft at the branch-way ends; also the body of a boy, shockingly burnt, at the entrance of the waste. Mr Telford, Mr Hurst, and other colliery viewers, were at the pit in the evening assisting, and every exertion is being made to thoroughly restore the ventilation, so that the pitmen may be enabled to pass through the pit in safety, and send up the bodies. But there was a good deal of stythe in the pit, and it may be a day or two before the bodies are all discovered.

As is usual at colliery explosions, there have been many providential escapes. George Mitford, one of the shifters, was working in another part of the pit at the time of the explosion. As soon as he felt the concussion of the air which is unmistakable in cases of explosion, he ran for his life, but was overtaken by the fire-damp, and was struck down like a shot. He gave himself up for dead, but was fortunately rescued by some men who descended the pit at the first alarm of the explosion to save as many as they could. There has not been so large a crowd about the pit as has been noticed at former colliery explosions in the district, and the people have been very well-behaved and orderly.

The poor man Holt is supposed to have occasioned the explosion by firing a "shot" while making a drift through a "trouble" close to the air way. The pit must have been extremely foul; but it is said that if it had been at work the explosion would not have occurred, as extra precautions would have been adopted if it had been found necessary to "fire a shot."

Before night on the 23rd, the bodies of the 16 men and lads had been brought to bank in coffins, and despatched in carts to their homes. The pit is little the worse for the accident, and will be made fit for work in a shift or two. The cause of the accident has not been ascertained.

In the interval since the above report, the Coroner's Inquest has been held, and a verdict given, "*Explosion Accidental.*"

A more preposterous one, as has been remarked by a writer in the *Times*, who signs Y,—and is generally understood to be Dr Percy—could scarcely have been conceived.

Blasting was, it appears, being carried on in the pit, it is not necessary therefore to seek for ignition in pocket lucifers or tobacco-pipes.

If a fiery pit in which blasting is going on, be not thoroughly ventilated about the region of the explosions, ignition of the fire-damp from the powder flame, or fuzes, or ignited coal-dust, is certain almost to follow. This was probably the "pure accident" here.

Since the preceding has been written, another terrible accident of an extremely like character has occurred on the St. Edmund's Main Colliery, near Barnsley. The workings are of great extent, and chiefly in a nine foot seam of very fiery coal. A straight heading was in process of being driven upon the dip, from one position of the work to reach another. In its execution, it was deemed desirable, if not necessary, to blast away some of the coal at the lowest point of the heading, and where the coal itself was much disturbed by "blowers" discharging considerable quantities of fire-damp. The shot was fired, the flash, it is said, ignited the coal, but more probably the flying coal-dust, or one of the blowers, and either, or both of these, the coal. The final and rapidly following result was, an explosion, of fire-damp probably liberated in increased volumes directly after the blast—which more or less deranged the air courses and ventilation of the pit; and was succeeded, soon after, by a second, which cleared away almost every stopping and brattice throughout the workings, and so destroyed all ventilation, except in the direct air-way from shaft to shaft.

A large number of men and boys, and several horses, succeeded in reaching the bottom of the shaft, and were got to bank—some of the men fearfully burnt by the searching flame of the first explosion; this was effected before the second occurred. But fifty-four men and lads have lost their lives, and with the exception of two, the corpses of all are in the pit, and must now, probably, remain there for weeks, if not months, to come, as it has been decided to "drown the pit," and to close up the shaft from the entrance of air, as the only methods of extinguishing the fire now established in the coal. There does not seem a probability of any of the persons who were below after the second explosion being still alive.

This terrible affair, in one sense, does bear the aspect of "an accident;" but if blasting be carried on under such circumstances as appear here to have existed, an accident is nearly certain to follow.

Blasting is sometimes indispensable, under conditions, which with every precaution, render it highly hazardous. In such cases, it would be much better to sacrifice some time and money by adhering to hand-hewing; and this, we have no doubt, might, even in the most awkward positions, be powerfully aided and expedited by the judicious use of that means of detaching coal or even rock, that was proposed by Mr J. Bramah, viz, by the use of the power of the hydraulic press (of which he was the inventor), for splitting out and wedging away masses of the mineral.

Bramah's mode consisted in pumping water into an extremely strongly made leather bag, which had been placed in a flaccid state within the cavity, or between the opposite surfaces, of a race, or chest cut into the coal to receive it; and he demonstrated that even this rude apparatus had power

enough, and sufficient readiness and durability, to be employed in prizing off blocks of slate in the Welsh and Westmoreland quarries. Far better, and more potent and easily applied, apparatus, on the same principle, could now be devised, and, we think, would be worthy the consideration and trial of the Northern coal viewers and mining engineers—men, than whom we know no higher type of engineers in any walk of the profession—courageous, cool, clear-headed, and sound in judgment; remarkably well informed generally (considering the miserable want of the means of education in sound and systematic technical knowledge and applied science that has existed always, and still exists in England), and ready to try without prejudice any expedient, however new or unusual, provided it appear to them feasible, in meeting the dangers and difficulties of their truly heroic calling.

If blasting must be employed, then should we also counsel the trial of gun-cotton, made into proper cartridges, as greatly preferable to gunpowder. The heat and volume of flash evolved from gun-cotton, are as nothing compared to those of as much gunpowder as will give the same amount of "work;" and the explosion and flash of the gun-cotton is so sudden that there is not *time* for the latter to ignite any solid whatever, and possibly not even gases. The rate of explosion is, roughly, to that of gunpowder as about 3 to 2; and as a blasting agent, it is enormously more efficacious than gunpowder. The "work done" by 3 lbs. of gun-cotton is equal to that of 8 lbs. of the *best sporting* gunpowder, or probably to 10 of common blasting-powder. See Mallet on Artillery, pp. 127-133. When gun-cotton was first discovered by Professor Schoenbein, a large firm of gunpowder manufacturers in this country made a great outlay in plant preparatory to starting the manufacture of the new explosive agent, and had made some tons of it, when the whole concern was blown up. Probably, this was really accidental, and owing to the little that was then known of the properties of gun-cotton; but public rumour at the time, rightly or wrongly, hinted that that explosion, at least, was not "purely accidental," and that it was designed to give the *coup de grace* to the threatened innovation upon the gunpowder trade, and improbable as this may be, such was the effect that followed. Gun cotton became looked upon, and has been ever since talked of, amongst "practical men" as a curious quackery, only fit to be in the hands of a chemist. But while we have thus slumbered and slept upon it, the Germans have acted very differently. The Austrian government has steadily persevered in a laborious course of experiments, and now may be said to have demonstrated its safety and its value as an explosive agent, in several respects superior to gunpowder. They have adopted it as the sole ammunition of several of their field batteries, and with these valuable results amongst others; of saving about one-half the length and therefore weight, of their guns, and the carriage of explosive material reduced in the ratio of 3 to 8.

The time seems, therefore, more than come, when we in England ought to have recovered the shock of the Dartford Mills explosion, and ought to institute, in well-informed and unprejudiced hands, a careful series of experiments, to ascertain whether the view that we now put forward be correct,—namely, that gun-cotton will be found a much safer and more manageable, and not more expensive, blasting material in coal pits than gunpowder. As to the expense question,—if fulminating *gold* had to be used, it would not be as expensive as gunpowder, with such results as are above recorded.—Ed.

THE GREAT EXHIBITION.

ART. VIII.

It is at length announced in the *Times*, (18th December, 1862) that the intention, previously promulgated by the Commissioners, of holding a state ceremonial, early next year, under the presidency of His Royal Highness the Prince of Wales, for the delivery of the medals, has been "reluctantly abandoned," owing, as is alleged, to the impossibility, upon an occasion merely temporary, of lighting and warming the building. That the building, or rather a sufficient fragment of it to afford ample space for the purpose, could have been readily lighted, and at moderate expense, does not admit of doubt, on the part of any who have seen the effect of the ring of gas lights round the interior of the dome of St Paul's. The warming is a different affair; and whether for temporary or permanent use, is, practically, (outlay and cost considered) pretty much on a par with warming Mont Blanc.

But, it might have been supposed possible, that conclusions such as these, resting on ascertainable physical facts, could have as well become known to the Commissioners six months ago as now, and before they took the initiative in bringing the name of the heir-apparent to the throne, in public connection with a project thus abortive.

It may, without want of charity, be concluded, that, in truth, it is not the physical, but the fiscal conditions of the matter, that make it, at this late moment, appear *impossible* to present the medals, with any ceremony, to those to whom they have been awarded; the *hiatus* in the balance of the accounts, is, probably, now discovered to be such as not to warrant further expenditure, small or great.

Thus, the *three tons* of copper medals that should have been all ready, and ought to have been presented on the same day that the awards were divulged, and then, with such sanction and ceremony as the means and taste of the Commissioners could supply, will now, we presume, reach the fortunate recipients of these honours, as best they may,—possibly, by the Parcels Delivery Company. Oh! lame and impotent conclusion, it needed but this to cap the catalogue of meannesses and mismanagements by which a grand memorial has been marred!

ROTATORY DISC BLOWING ENGINES.

By M. E. Fossey, *Engineer.—Illustrated by Plate* 295.

This machine, which many of our readers will recollect to have seen at work in the late Exhibition, where it constituted a prominent member of the Belgian display of machinery, is represented in our plate of this month. The inventor and designer is Mons M. E. Fossey, Mechanical Engineer, and Manager of the Engineering Works in Lasarte, in Spain; and the pair of blast engines exhibited were constructed by Mons. M. L. Perard, of Liege. The distinguishing peculiarity, as will be remarked, consists in the substitution, for *clack* valves, of revolving perforated discs, at both ends of the blast cylinders, which, in fact, play the part of *slide* valves. The late period of completion of the copper plate obliges us to postpone to next month the full description of the arrangement, when we also hope to connect it with some critical remarks upon this and other forms of blowing engine, and on the principles that should regulate the choice in the arrangement of their important parts.

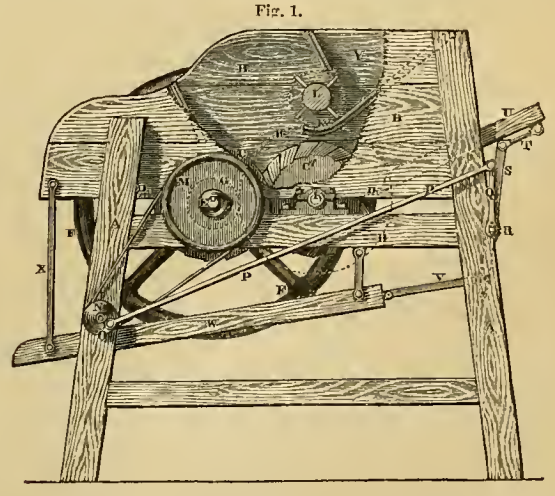
RECENT PATENTS.

CRUSHING MACHINE.

James House, *Lavington, Wilts, Engineer.—Patent dated May* 10, 1862.

This invention has reference to the arrangement and construction of machinery for crushing, or reducing, and working various substances, such as guano, grain, oil-cake, clay-mortar, and cements. According to this invention, it is proposed to employ a pair of peculiarly constructed rollers, driven either at the same, or different speeds, in relation to each other, by a suitable arrangement of gearing. These rollers may be either made in one or more parts, and composed of steel or chilled cast iron. In place of being cylindrical, they are formed, on their surfaces, with a number of alternate V-grooves and projections, the projections of one roller working into the grooves of the opposite roller. These grooves and projections may be smooth on their outer surfaces, or they may have a series of teeth or notches formed on them, with a view to

Fig. 1.

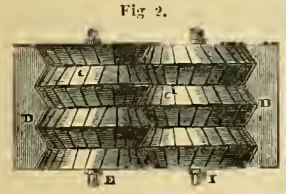


the more effective reduction or disintegration of the substance under treatment. When these rollers are made in several parts, each part consists of a disc, having its periphery bevelled on each side, so as

to represent an Λ or knife edge. By placing a number of these discs upon a square shaft, a roller of the description before referred to is obtained, each disc being formed with a series of teeth or notches on the bevelled edges, or made smooth, as before described. In some cases, it is proposed to use, in combination with these rollers, a feeding roller, provided with a number of projecting pins or cups, as the case may be, this roller works at the bottom of a feeding hopper, and tending to feed the substance in a regular manner to the grinding rollers, the feed roller being driven by suitable gearing from the reducing rollers. It is also proposed to use, when requisite, a vibrating screen or sieve in combination with the above described mechanism, for the purpose of cleaning or sifting the substance as it leaves the rollers. In order to keep the rollers clean, and prevent them from becoming clogged, as in some cases they may be liable to do, a "doctor," or "scraper," is applied to one or both rollers.

Fig. 1 of the annexed engravings represents a side elevation of this improved machine, with a portion of the side partly broken away, to show the internal arrangement; and fig. 2 is a detail plan of the peculiar rollers and the "doctors" in connection therewith. A is the main framing of the machine, to which are applied the two side pieces, B, one of which is partly broken away, as above described. cc¹ are the two rollers, having annular V-grooves, made therein, and provided, or not, with teeth or serrations, as required upon the surfaces of the grooves.

Fig 2.



The "doctor" plates, D, are secured to the framing, and so shaped as to correspond to the peculiar form of the rollers. The main driving shaft, E, may or may not form the axis of one of the rollers. It is provided with a fly wheel, F, actuating handle, or driving pulley, and carries a spur pinion, or small spur wheel, G, (shown by a dotted circle) gearing into a large spur wheel, H, fast on the axis, I, of the second roller. This wheel gears also into a pinion, or small spur wheel, K, fast on the axis of the feed roller, L, which is provided with spikes or cups, on its surface, as before described. On the opposite end of the main driving shaft, E, there is keyed a grooved pulley, M, which transmits motion, by means of a band, to the small pulley, N. This pulley carries an eccentric pin, O, which imparts a longitudinal vibrating motion to the connecting rod, P, jointed, at its opposite end, to the rocking lever, Q, on the transverse rocking shaft, R. To the middle of this shaft is keyed a second rocking lever, S, projecting both above and below the same, the upper end being coupled by means of a link, T, with a vibrating feeding spout, U, whilst the lower end is connected by the link, V, with the top of the inclined vibrating riddle or sieve, W, the lower end of which is suspended by the links, X, from the side pieces, B, of the machine. The material or substance to be operated upon is fed in from the vibrating spout, U, if the spiked feeding roller is not required, or from the stationary feeding hopper, Y, if the action of the feeding roller be found requisite, and is thence carried, if fed from the latter hopper, by means of the feeding roller, L, to the crushing rollers, cc¹, one of which, in some cases, may revolve faster than the other, so as to give a draw-crushing action, and finally drops into the vibrating sieve or riddle, W, should a screening action be found desirable.

MANUFACTURE OF RED LEAD.

J. H. Johnson, *London and Glasgow*—(C. L. P. Burton, *Paris*).—*Patent dated May* 8, 1862.

This invention consists of improvements in the conversion of oxides of lead when free or uncombined, and of certain basic salts of lead, into minium or red lead, by mixing the same with either nitrate of potash or soda, and with either carbonate of potash, or carbonate of soda, or mixtures of the same, and subjecting such mixtures to the action of an elevated temperature whereby the oxide of lead is oxidised and is converted into red lead.

In carrying out this invention it will be found that if oxide of lead, or a certain number of its saline basic compounds be brought in contact with the nitrates of potash or soda there will always result, when the mixture is brought to and maintained at a dull red heat, the following decomposition, that is to say—1 equivalent of alkaline nitrate is transformed to the state of nitrate, and the 2 equivalents of oxygen, which are liberated, will be employed for superoxydising 6 equivalents of oxide of lead, so as to form 2 equivalents of red lead, 2 Pb_3, O_4. It is evident that we have nothing to do here with salts of lead, the acids of which would be destroyed and burnt before the oxide became superoxydised, and that we are only treating of those salts whose acids are permanent; as for example, carbonates, hydrates, sulphates, phosphates, arseniates, borates, nitrates, and chlorides of lead; the first two are employed in their natural state, and the other five with the addition of, for each equivalent of salt one equivalent of carbonate of potash or carbonate of soda, so as to give to each of them a basic character which they must possess in order that they may react as required in this decomposition.

In the treatment of sulphate of lead, for example, the mixture should be as follows:—

	Parts by weight.
1 equivalent of purified and dried sulphate of lead, or ...	1·894
1 equivalent of carbonate of soda, or	0·665
$\frac{1}{6}$ equivalent of nitrate of soda, or	0·143

This mixture, when heated to a dull red heat in presence of an excess of nitre would, after the reaction has ceased, form a mass of a beautiful red vermilion colour containing the superoxyde of lead. And as this last is insoluble, it suffices to lixiviate this mass with water which dissolves all the soluble salts, (sulphates, nitrates, and nitrites,) and to allow the residuum to drain, and, subsequently, to be dried. In collecting the products of this process with care, we obtain, within a few fractions, the theoretical quantities of red lead of soluble nitrites and of sulphates which result from the above equation. We find in effect—

	Parts by weight.
Red lead, ...	1.427
Sulphate of soda, ...	0.800
Nitrite of soda, ...	0.143

The fusion of the mixtures from which the red lead is produced should be made in vessels capable of resisting the action of heat, also, that of the nitre when in fusion, and of the lead compound in the process for the manufacture or production of minium which has been described; the product has a definite composition, represented by the formula Pb_3, O_4, and possesses properties that are peculiar to it, and which distinguish it from red lead prepared by the old process. The patentee does not limit himself to the precise mixtures herein given, nor to the quantities of such mixtures, but reserves to himself the right of producing red lead or minium in accordance with the principles herein described, subject to such modification as may be found available in carrying out this invention.

PERMANENT WAY OF RAILWAYS.

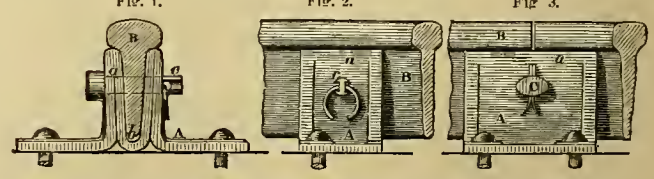
John Ashbury, *Manchester.—Patent dated April* 16, 1862.

This invention relates to an improved mode of securing the rails of the permanent way of railways, whereby greater economy and simplicity are obtained, and the operations of laying and removing the rails are considerably expedited.

According to this invention, it is proposed to use a rail having the ordinary bearing flange at its upper surface, but with a slightly tapered or wedge-shaped web in transverse section, the narrowest portion of the rail being at its lower edge. This rail is dropped into a chair, the inner surfaces of the jaws of which are made to approach each other towards the lower portion of the chair, thus presenting a tapered or wedge-shaped opening or trough for the reception of the correspondingly tapered web of the rail, which fits it accurately at the sides. Any heavy weight passing over the rail will tend to force it down into its chair, and will, consequently, still further tighten it therein without the necessity of keys or wedges of any kind. If desired, a small wooden bearing piece may be inserted into the bottom of the chair to receive the direct pressure of the rail, but this may be dispensed with, if preferred. The rails may be prevented from rising from their chairs by pins or bolts passing transversely through the rail and jaws of the chair, a ring or collar serving to prevent the accidental displacement of the bolt, but in some cases these bolts or pins may be dispensed with. The joint chairs are made like the intermediate chairs, but wider, and a bolt or pin is passed through the two jaws and through an opening made between the rail ends, so that one bolt will serve to hold down both rail ends. It is preferred to form these chairs by rolling them from wrought-iron plates, but they may also be made of cast iron, if desired.

Fig. 1 of the accompanying engravings represents a transverse vertical section of this improved form of rail and chair, which latter is here shown as made of wrought-iron; fig. 2 is a corresponding side elevation

Fig. 1. Fig. 2. Fig 3.



of a portion of the rail in its intermediate chair; and fig. 3 is a similar view of the joint chair, showing the mode of securing or holding down the rail ends.

A is the chair, which in this case is made from a wrought-iron plate, bent or doubled in the form shown, so as to leave a tapered trough or opening between the inner faces of the two jaws, *a*. This chair may be secured to any suitable form of wooden or other sleeper by any of the well-known contrivances. The rail, B, is single-headed, and is formed with a tapered web corresponding exactly with the tapered trough in the chair. This rail is dropped into the chair, its sides being in direct contact with, and fitting accurately against the inner faces of the jaws. A space, *b*, may be left between the bottom of the web of the rail and the chair, or, if preferred, this space may be filled in with wood or other suitable yielding substance. C, are bolts or pins passed transversely through the jaws of the chair and through the web of the rail for the purpose of preventing the rail from jumping or rising from its chair, these pins being held in their places by rings or collars, as shown. In the case of joint chairs (fig. 3) the pin may have an oval or other section, and made to enter coinciding notches in the abutting ends of the two rails. The advantages obtained by this system of permanent way are,—

1st. If the chairs be made of wrought-iron, all risk of breaking is avoided, which amounts to a considerable per centage where cast-iron chairs are used.

2nd. The form of rail is such that the same sectional area of an ordinary rail is preserved, and a better and stronger form given to it.

3rd. The simplicity of the mode of fastening the rail to the chair.

4th. The short time in which a rail can be changed, a few minutes sufficing to perform the operation, all that is required to be done being to take out a few bolts (which may be secured either by a cotter or a nut); lift out the rail, and put in another.

5th. The complete safety of the chair and rail, wood keys being dispensed with, the liability of their getting out, and the rail becoming loose is avoided.

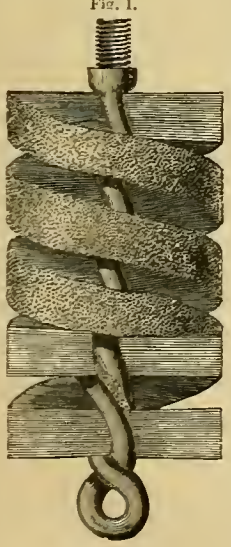
6th, The amount of elasticity that a wrought-iron chair possesses over a cast-iron one, thus rendering the line smooth and pleasant to travel upon.

CLEANING THE TUBES OF BOILERS.

J. H. Johnson, *London and Glasgow*—(Claude Dumas, *of Paris*).—*Patent dated March* 26, 1862.

These improvements comprehend the manufacture and use of a new kind of brush, intended for the cleaning of the tubes and flues of steam boilers, and similar conduits or passages, from the rush known in South America as "piagava," or "bastin," either as an entire substitute for bristles, or tufts of wire, or in combination with these substances. The tufts of rushes are fixed in any convenient manner into a stock of wood, or into branches or stems of wire, and are then trimmed to a cylindrical, or other desirable form.

Fig. 1.



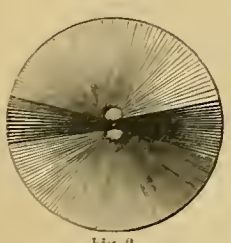


Fig. 2.

Fig. 1 of the annexed engravings represents, in half elevation and section, a circular spiral bush, suitable for cleaning boiler tubes, composed of the vegetable substance before described, in lieu of ordinary bristles or wire. Fig. 2 is a sectional end view of the same, corresponding to fig. 1, both drawn to one-third of the natural size. The patentee does not confine himself to any particular mode of securing the tufts or short lengths of rush into their stock or holder; yet, for circular brushes of the kind referred to, he prefers to place them between two parallel lengths of stout wire, or metallic rods, capable of being easily twisted together in a cold state, and of retaining their twisted form. This mode of securing the tufts or short lengths of rush is both simple, economical, and effective, the rush being firmly nipped in the centre, between the two rods, by merely twisting such rods together in a spiral form, the same operation imparting a spiral or helical formation to the brush itself, as will be seen on referring to the engraving. For convenience of use, the two rods may be welded together at one end, so as to form a single stem, which may have a screw thread formed upon it, for the purpose of screwing into a socket in the end of a long rod or handle.

MANUFACTURE OF SODA AND POTASH.

J. H. Johnson, *London and Glasgow*, (C. L. P. Burton, *Paris*).—*Patent dated May* 6, 1862.

This invention consists, firstly, in mixing natural or artificial sulphate of soda, obtained either by the decomposition of marine salt, chloride of sodium by sulphuric acid, or by means of sulphate of iron, with about 35 per cent., by weight, of powdered charcoal, or its equivalent of coal anthracite, or other suitable reducing organic substances, and then subjecting this mixture to a red heat, either in closed vessels, or in a reverberatory furnace, under the influence of a reducing flame. The hearth of such furnace should be composed of cast iron, coated with copper, or with zinc, as the employment of fire brick, or earthy matter, renders the process impracticable by reason of the energetic action of the alkaline sulphides upon alumina, silica, and argillaceous substances. The mixture is maintained at an elevated temperature, so long as carbonic oxide is disengaged. When this ceases to be produced, and when the sulphate is completely transformed into a sulphuret, the operation is discontinued, and the mixture is allowed to cool, care being taken to exclude the air therefrom, and to prevent the formation of the hypo-sulphate of soda. The fused mass is then treated with hot water, in order to dissolve the alkaline sulphuret, and to separate it from the excess of charcoal, which has been requisite for ensuring the complete reduction of the sulphate of soda. In carrying out this operation, arrangements must, of course, be made for effecting a thorough lixiviation, or washing, and obtaining concentrated solutions or liquors. The third and last operation consists in subjecting the concentrated solutions or liquors to a boiling temperature, for about thirty minutes, with some desulphurising agent, which shall combine with, and render insoluble, all the sulphur composing the sulphuret, whilst, at the same time, it produces its equivalent quantity of soluble caustic soda, in its pure state, should these processes have been properly carried out. The sulphuretted compound, produced by the reaction above referred to, having been perfectly washed and dried, is placed in communication with what is known as a leaden chamber, for the manufacture of sulphuric acid, upon a plate of cast iron, which is heated, in order to burn or roast the compound, so that it may throw off the combined sulphur in the form of sulphurous acid, which may be directed through the leaden chamber, and may be transformed into sulphuric acid. After this roasting, the compound becomes re-vivified, that is to say, it has entirely regained its desulphurising properties. This property is not, however, confined to a single compound, or metallic oxide, but is possessed by certain other metallic oxides, carbonates, or hydrates, which, under a greater or less pressure, in conjunction with the before-mentioned soluble sulphurets, become sulphuretted at the expense of the sulphur contained in the alkaline sulphurets, which are placed in their presence. The oxide of iron, in its native condition, may be employed for the decomposition of sulphuret of sodium; but, according to the state of aggregation of this body, the reaction will take place at the ordinary pressure, or at a higher pressure, which may be obtained by boiling in closed vessels, and at an elevated temperature. It sometimes happens that when oxide of iron, either natural or artificial, is employed for the abstraction of the sulphur from the solutions before mentioned, that the sulphuret formed has a tendency to oxidise, and to form certain sulphates of iron. This inconvenience may be obviated by the employment of oxide of copper, which is employed, by preference, especially as the desulphurisation of the solution is more easily and perfectly accomplished. The oxide of copper may be obtained, commercially, by decomposing one equivalent of sulphate of copper, obtained by roasting copper pyrites with one equivalent of nitrate of soda, or potash, whereby a soluble sulphate of soda, or potash, is obtained. The finely-divided insoluble oxide of copper is easily separated. The operation being carried on in connection with a leaden chamber, the nitrous vapours are directed through such chamber, and serve for the manufacture of sulphuric acid. On boiling the oxide of copper obtained as above, with alkaline sulphides, a complete decomposition is obtained with the production of the hydrates of soda, or potash, and of the sulphide of copper, which precipitate, after being separated, washed, and dried, will regain its desulphurising properties by being roasted or calcined. These improvements, however, consist in the employment, not only of the oxides of the several metals, which are capable of combining with, and of abstracting, the sulphur from alkaline sulphides in solutions, but in the employment of carbonates of the metallic oxides; and the patentee has found that the desulphurising of solutions, as before mentioned, may be effected sometimes more advantageously when the second decomposition is effected in closed vessels, under pressures, and at an elevated temperature. The solution of caustic soda, or of carbonate of soda, resulting from the operations, may be concentrated, or may at once be employed in the arts.

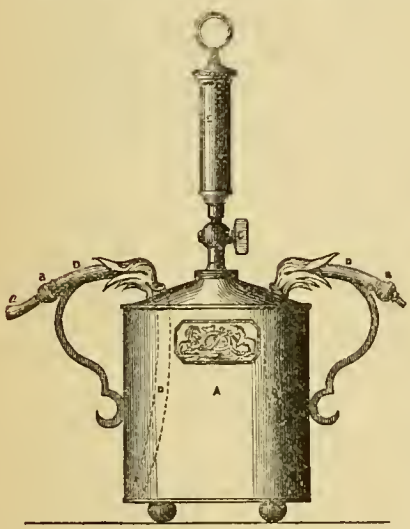
The process which has been found to answer the best for the preparation of metallic oxides, to be used in the decomposition of alkaline

sulphides, consists in mixing one equivalent of nitrate of soda, or of potash, with one equivalent of the metallic sulphide, then to heat the mixture, so as to effect a double decomposition, the final result of which is—1st, One equivalent of soluble sulphate of potash, or soda; and 2d, One equivalent of insoluble metallic oxide and nitrous products, which are utilised by passing them through leaden chambers, where they serve for the preparation of sulphuric acid, as before mentioned. These improvements, which have reference to the production of soda from sulphate of soda, are also applicable to the production of caustic potash, and of carbonate of potash, from the sulphate of potash. It is simply requisite to replace the sulphate of soda by sulphate of potash; but, in lieu of using 35 per cent. of charcoal, about 28 per cent. only should be employed.

FLUID DISTRIBUTING APPARATUS.

A. Robertson *and* R. Barter, *Dublin—Patent dated April*, 23, 1862.

This invention relates to an arrangement and construction of apparatus suitable for distributing and projecting, disinfecting or other fluids in the wards of hospitals, or for any other purpose where it is required to project a jet or jets of fluid for the distribution or diffusion of the same. The accompanying engraving represents a side elevation of this apparatus. It consists of an air-tight strong vessel, A, provided with two or more stop-cocks, B and C. One of these cocks, C, is removable for the purpose of enabling the vessel to be partially filled with the fluid to be distributed, and the other cock or cocks, D, are connected with pipes, D, which pass down inside the vessel to near the bottom thereof, as shown in dotted lines. These last mentioned cocks are so made as to enable a rose jet, *a*, or other form of distributing nozzle to be attached thereto. When the vessel is supplied with the fluid, the stop cock, C, is replaced and a small air pump, E, is connected thereto, for the purpose of forcing air into the vessel which when fully charged is ready for use, the pressure of the air on the fluid forcing it out through the jets when the corresponding cocks, B, are opened. When the vessel is fully charged with air the cock, C, is shut and the air pump removed.



TREATING SUBSTANCES CONTAINING PARAFFIN.

Leo de La Peyrouse, *London.—Patent dated May* 8, 1862.

The object of this invention is the treatment of the neutral and acid fatty and oily substances, and of resins or resinous substances, and of products and compounds containing paraffin, in order to obtain products or compounds suitable for the manufacture of soap, or for the manufacture or production of candles, and consists in subjecting these substances, compounds, or products, containing the same to the action of azoto sulphuric acid, or of sulphuric acid containing azoto sulphuric acid in solution, and to the products of the decomposition of azoto sulphuric acid by means of water, and also to the products of its decomposition by means of water and of organic matters.

Azoto sulphuric acid may be obtained by pressing nitrous acid into, or by mixing the same with sulphuric acid, or it may be obtained either by the direct combination of azotous or nitrous acid and sulphurous acid, or of hypoazotic acid and sulphuric acid, or by any other means. These improvements further consist in subjecting the substances before-mentioned to the action of a salt or compound of nitric acid, as nitrate of soda, or any other suitable nitrate in conjunction with sulphuric, or any other suitable acid with the addition of a reducing substance or agent such as treacle, saw-dust, starch, or any other suitable reducing agent, so that when these substances react upon each other the nitric acid may be reduced and the desired compound of nitrogen may be produced. These improvements also consist in subjecting the substances and products firstly before-mentioned to the action of a nitrite such as nitrite of soda, or any other suitable nitrite, in conjunction with an acid such as sulphuric acid. The substances and products first mentioned, when being subjected to any of the processes of treatment described, are either to be melted or heated in a suitable vessel, alone or with water, in which case the substances or products under treatment will, when melted, float on the surface of the water. After the fatty, oily, and other substances or products before mentioned, have been subjected to any of the modes of treatment herein described, they are to be washed with water so as to remove any acid salts or other impurities remaining, and they may then be employed either in the manufacture of soap or for the manufacture or production of candles, to which purpose paraffin is more particularly adapted.

In carrying out this invention in practice the method of procedure is as follows:—The fatty and other substances are maintained in a fluid state, and are mixed with from 5 to 10 per cent. of common sulphuric acid, containing in solution from 1 to 2 per cent. of azoto sulphuric acid, produced either by the direct combination of nitrous and sulphurous acids or of hypoazotic acid and sulphuric acid. After having been allowed to remain in contact from 6 to 12 hours, according to the materials operated upon, and after having undergone repeated washings with hot water until all traces of acid are removed, the fatty and other substances when cold will be found to have considerably increased in hardness, and if now subjected to distillation in a current of superheated steam, a larger amount of material, fitted for the manufacture of candles, will be obtained than would have resulted had the ordinary process of manufacture been adopted. Or, azoto sulphuric acid may be gradually added in small quantities to a small quantity of tepid water, on the surface of which the melted fatty or other substances float.

The patentee has found that the azoto sulphuric acid may be advantageously employed in the proportion of ½ to 1 per cent. to the fatty and other matters to be treated. The fatty and other substances after having been subjected to the before-mentioned treatment when cold, and after having been subjected to repeated washings, so as to remove all traces of acid, may be saponified with lime, as is well understood, and, in this case, even a larger quantity of solid fatty matter is obtained on decomposition of the lime soap by means of a suitable acid. Or, the fatty substances and products are maintained in a fluid state, and are agitated with a mixture, previously prepared, of from about 1 to 2 per cent. of azotic acid, or of an azotate, or of an azotite, and with organic matter such as treacle, starch, dextrine, saw-dust, &c., alone or held in suspension in water. These are well mixed together, and sulphuric acid is gradually to be added thereto, taking care that continuous stirring be maintained in order that the whole may form as homogeneous a mass as possible. The result is a reaction by which azoto sulphuric acid is produced. This product re-acting on the organic matter and on the water is gradually decomposed, from which decomposition bubbles of gas are thrown off; should these escape too quickly, the decomposition is to be arrested by the addition of tepid water to the mixture. In all cases the fatty substances and compounds, when treated as before described, the products, after having been washed with water, and when either subjected to distillation or to saponification, will be found to yield a much larger proportion of solid matter fitted for the manufacture of candles, or the production of soap, than when treated by the ordinary processes of manufacture. It is to be understood that paraffin and substances containing paraffin are not to be subjected to the saponification process but to this distillation only.

LAW REPORTS.

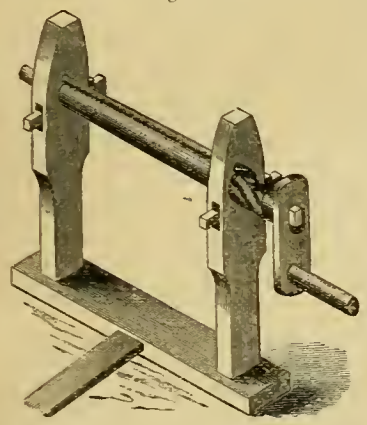
Cotton Gins.—Prolongation—Burn's Patent, Nov. 26.—This was a Petition to the Judicial Committee of the Privy Council by Mr Robert Burn, of Edinburgh, for a prolongation of the term of Letters Patent, granted to him on the 2d December, 1848, for his invention of "An Improved Roller Gin, used in separating the seed from cotton," and was heard before the Right Honourable Lord Chelmsford, Lords Justices Knight, Bruce, and Turner, and Sir J. T. Coleridge.

Mr Grove, Q.C., instructed by Mr J. Henry Johnson, of Lincolns-Inn-Fields, appeared for the petitioner, and stated the case. It appeared that Mr Burn, in the year 1843, went to India, to engage in the cotton manufacture, and devoted his time for several years at Broach, in the Bombay Presidency, and in travelling about, in the investigation of the difficulties which then existed in the manufacture of cotton. The ginning, or separation of the fibre of the cotton from the seed and other matters, had, up to that time, been performed by a rude instrument of Indian contrivance, called the "Churka" gin, of which we give an illustration at Fig. 1, and which consists of nothing more than a

wooden frame, with a pair of parallel rollers, one of wood, and the other of iron, working in contact, and turned by twisted gearing, the peculiar character of which prevented them from travelling at a uniform surface rate, and through which rollers the fibres alone of the uncleaned cotton were drawn, the seeds and other foreign matters being dropped in front of them. The rollers, however, being tightly wedged together, the passage of the cotton was rendered very difficult, by reason of the rollers not travelling at a uniform surface rate; and being held in bearings, without any elastic or yielding principle, the wooden roller was liable to crack and become untrue, and the staple of the cotton was thereby injured, and great wear was caused in the apparatus generally.

Mr Burn made a great many experiments, and ultimately succeeded in overcoming these difficulties; but proper materials not being obtainable in India for constructing a machine upon his new principle, he returned home to Scotland, where he perfected his invention after great labour and expense, and subsequently obtained his patent.

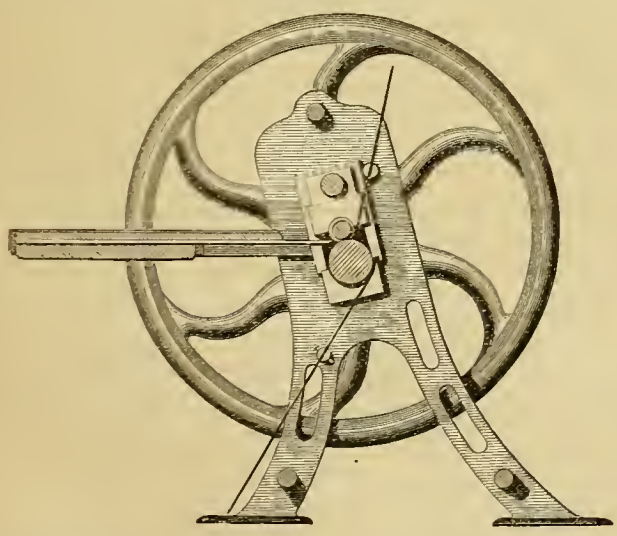
Fig. 1.



The specification of the letters patent in question described an improved gin, consisting of the application of a brush, fan and steel roller, with moveable steel bearings, and fixed steel bearings applied to the steel roller and wood roller, and an endless cloth or apron, with card-teeth, and a fly-wheel; by the use of which appliances the cotton is freed from all extraneous materials more completely than by the previous roller gin; the cotton is drawn through the rollers without any difficulty, and great rapidity can be attained in the operation; the gin works with greater accuracy and lasts longer, and the cotton is supplied to it more regularly than by hand, and at less cost than by manual labour.

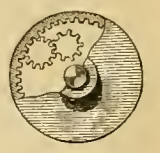
The petitioner was examined, and proved the advantages of his improved gin over the churka gin, and the trouble and expense which had been occasioned to him in making and perfecting his discovery, and

Fig. 2



stated that since the date of the patent he had supplied many specimens of his machine to various persons, and some to the English and French Governments, and to the Jamaica Cotton Company, and the Cotton Supply Association; but owing to the cheapness of American cotton, and the slow development of the Indian cotton trade, he had not succeeded in bringing his invention into general use, although it had been commended in high terms by eminent persons. It further appeared that the petitioner had lately adopted a modification of the roller gin described in the specification, and substituted a hand gin upon the same principle, for which there was every reason to believe, now that the prospects of the Indian cotton trade had improved in consequence of the American war, there would be a great demand; and it was a singular fact, that since the date of the present petition, the petitioner had actually received an order from the East India Cotton Agency Company for 100 of the hand gins, being more than the total number of gins he had supplied during the whole term of the patent, so that, if the patent were prolonged, there was every prospect of his being at length rewarded for his labour and outlay. Illustrations of the petitioner's hand gin are given in figs. 2 and 3; and the special advantages of that modification were stated be that it is light and portable, and may be advantageously used as a domestic gin by the families of the native cultivators. The petitioner proved that he had lost about £300 by the patent.

Fig. 3.



The Attorney General appeared on behalf of the Crown, and stated that he could not deny there was merit in the invention, but that gins for superseding manual labour were the articles which the petitioner by his specification claimed as his invention, and the demand for them had ceased. Their lordships, after some consideration, decided that no case had been made out for the interference of the Committee, and the prolongation was therefore refused.

Electric Telegraphs.—Prolonoation.—Bakewell's Patent, Nov. 26.—This was a similar petition of Mr F. C. Bakewell, for a prolongation of the patent granted to him, 2d December, 1848, for making communication from place to place by means of electricity.

Mr Macgregor appeared for the petitioner, and stated that, under the present system, the correctness of a message depended on the correctness of the clerk, but Mr Bakewell's invention obviated that disadvantage. By a chemical agency, the message, as written by the sender, was received in fac-simile. The process was, that the sender wrote on tinfoil covered with varnish, which was removed in writing, and at the other end a perfect fac-simile was produced. By the patentee's system, and no other, a drawing or plan, or even a portrait, or patterns of silk, could be reproduced by telegraph messages, could also be sent in cypher, and even totally undiscernible, for the paper on which the message was received would appear perfectly clear from marks until it had been placed by the person to whom it was addressed in a chemical solution. Messages had been successfully sent as experiments between London and Brighton, and on 600 miles of French railways, and the invention had been much praised by the officials of the electric telegraph companies, but they had declined to adopt it, as it would entail expense in its substitution for the existing system. Mr Macgregor then read some of the best authorities in favour of the invention.

Lord Chelmsford said that the learned counsel, he supposed, only used that to show that Mr Bakewell had made his invention known; and if that were so, and it had not been used, that was rather against its utility.

Mr Macgregor said the patentee, in seeking for a prolongation, relied on the extension of lines, and then his invention would become a necessity. Up to the present time, as it had not been used, the patentee had received no benefit, but, on the contrary, had been at a loss of from £200 to £300.

The formal proofs having been put in, the petitioner proved the case as stated by counsel.

The Attorney-General said that no doubt the invention was very ingenious and beautiful, and the inventor had reaped no benefit, but it would be dangerous to grant a prolongation of a patent where no user had been proved. With that remark he would leave the case in their lordships' hands.

Lord Chelmsford, in delivering judgment, said their lordships had, on more than one occasion, intimated that they would not advise a prolongation where there had been no user, which was always a presumption of inutility, which, however, it was competent to meet by rebutting evidence, which, if satisfactory, would be an answer to the presumption. This invention was very beautiful, and reflected the highest credit on Mr Bakewell; but as he had made it known, and it had not been used, he could only speculate that it would be adopted if their lordships granted a prolongation. Therefore, while admitting the great merit and beauty of the invention, their lordships, acting on a reasonable principle, could not recommend the prolongation of the patent.

Manufacture of Leather in combination with other Substances and Waterproof Fabrics.—Prolonoation.—Clarkson's Patent, Nov. 29 and Dec. 1.—This was a petition of Thomas Charles Clarkson, for a prolongation of the original term of his patent of 8th February, 1849, for the above mentioned invention.

Mr Macgregor, instructed by Messrs Prichard and Collette, appeared for the petitioner; the Attorney-General and Mr Welshy watched the case on behalf of the Crown.

The first part of Mr Clarkson's invention relates to a new process of tanning, and the second to the manufacture of mill hands and straps; the petitioner, however, did not rely upon either of these heads of

invention, but rested his claim to the prolongation on the third and fourth heads, the third was a peculiar mode of combining leather with vegetable substances, with or without canvas, silk, and cotton, or other fibrous materials, and the fourth combining layers of cork, and layers of fibrous materials, with a solution of india rubber in the formation of hat-linings.

The petitioner stated that when cork is cut into thin sheets, and placed between two layers of woven fabrics, canvas, cotton, cloth, wool, or leather, the whole being combined together by india rubber solution, a soft and pliant material is produced, which does not readily lose the shape it may have been moulded into, whilst, at the same time, it is light, cheap, and durable. This material is applicable for building carriages, boats, pontoons, tents, etc., also for making shakos, helmets, and other coverings for the head, and for boots, shoes, portmanteaus, saddles, etc. The petitioner produced specimens of these various articles, and showed the advantages obtained by their use. It appeared that the petitioner had used every exertion to introduce the invention, but had failed to do so to any considerable extent, but from recent Government orders and otherwise, the invention now appeared to be likely to come into general use. The Petitioner's accounts showed a profit of £226 only, against which he had set off no charges for rent or taxes, or for his own time occupied with the introduction of the invention.

Sir Thomas Trowbridge, Sir James Scarlett, Lieut.-Col. Hudson, and Colonel York, spoke in favourable terms of the merits of the invention for military purposes.

The Judicial Committee, consisting of Lord Chelmsford, Sir J. T. Coleridge, and Lords Justices Knight Bruce, and Turner, finally decided to recommend Her Majesty to grant a prolongation of five years.

Betts' Patent: Capsules—Prolongation. Nov 27 and 28. Before Lord Chelmsford, Lords Justices Knight Bruce, and Turner, and Sir J. T. Coleridge.

This was an application by Mr William Betts, the well-known capsule manufacturer, of Wharf Road, City Road, London, for the extension of the term of his patent of 13th January, 1849, for "A new manufacture of capsules, and of a material to be employed therein, and for other purposes."

Mr Grove, Q.C., and Mr Webster appeared for the petitioner, Mr Bovill, Q.C., and Mr Macroy opposed on behalf of Mr Clifford, of Birmingham, Mr Hindmarch, Q.C., and Mr Aston, instructed by Mr J. Henry Johnson, opposed on behalf of Wimshurst's Metal Foil Company, and Mr Hindmarch and Mr Macroy opposed on behalf of the representatives of the late Mr J. D Morries, Stirling.

Our readers are already conversant with the subject of Mr Betts' invention, the manufacture of a new metal composed of lead coated on one or both sides with tin by pressure, and also with the various stages of litigation, through which the patentee has passed.

The accounts filed by Mr Betts showed that he had made a nett profit by his business of about £50,000 during the term of the patent, and that, in addition, he had expended about £20,000 in law costs, but as his counsel ingloriously contended that only one-third of the profits should be considered as due to the patent, and that all the law costs ought properly to be charged against that one-third, he, of course, reduced the actual profit to something infinitesimal.

The objectors relied principally on the large amount of profit which they alleged had actually been made by the patentee, and also upon the fact that a foreign patent for the invention had been granted and had expired, and that, consequently, under the terms of the Patent Law Amendment Act, 1852, the Judicial Committee had no power to grant a prolongation. A very elaborate judgment was delivered by Lord Chelmsford on the 9th December, and as it possesses so much interest to patentees we give it nearly verbatim.

The petition was opposed, and the parties who had entered caveats produced at the hearing, amongst other evidence, two patents which had been granted for the same invention in foreign countries. One of them was a French patent, dated 16th January, 1850, for fifteen years, granted to Mr Betts himself; the other a Belgian, patent dated 27th January, 1852, for ten years, granted to another person on his behalf. The Belgian patent expired on the 27th January last. It was contended that by the 25th section of 15 and 16 Vict., cap. 83, these foreign patents, (and especially the one which had expired,) deprived the Judicial Committee of the power to entertain the application for the prolongation of the term of the patent in question.

The objectors say that although the former part of this section is confined in terms to cases where the patent has been taken out in a foreign country before the grant of the patent in the United Kingdom; yet that the proviso at the end is not properly a proviso upon the section itself, but is applicable, generally, to every case of the grant of a patent here, where a patent for the like invention has been granted in a foreign country, and has expired. And that this applies as well to the extension of the term of a patent as to an original grant, as by the 5 and 6 Wm. IV., cap 83, and 16 and 17 Vict., cap. 115, the prolongation of a patent is the same as a new grant.

It was admitted that no case exactly like the present could be found; but it was said that the question had been virtually decided by Aubè's case in 9 Moore, and Newton's case (not yet reported). These cases, however, upon examination will be found not to be authorities for the construction contended for. In Aubè's case the patent sought to be prolonged was founded upon a foreign importation, the invention having been previously patented in France, and the French patent having expired. Therefore, whether the proviso was to be construed to be of general application, or was to be confined to the patents mentioned in the preceding part of the section, in either case the petitioner was within its terms, and no extension of his patent could be granted. Newton's case differed from Aubè's case in this respect, that the English patent preceded the American one by upwards of three weeks. But the Judicial Committee appears to have regarded this priority of the English patent under the circumstances as of no substantial importance. The inventor was an American; his intention evidently was to take out patents for his invention in America and in England at the same time; and with a view to this object he employed Mr Newton, a patent agent, to take out in his own name, the patent in this country. The decision turned entirely upon the special circumstances of the case. Their Lordships say:—"It appears that the decision of this case rests upon a very narrow principle indeed. The two patents were granted almost simultaneously, and though this case does not come within the letter of the statute, it appears to their Lordships to come within the true spirit of it; and their Lordships are of opinion that, under these circumstances, they, in the exercise of their discretion, ought not to advise Her Majesty to grant a prolongation of the patent." This decision can hardly be considered to have settled the construction of the Act in all cases where a foreign patent has been granted, whether before or after the time of the grant of an English patent.

In the present instance, however, the construction of the section in question is brought to the test because the Belgian patent, which is principally relied upon. was taken out three years after the English patent, and had expired more than a year before the time of the hearing of the petition for extension. If the construction contended for by the parties opposing the application be correct, then, as was pointed out at the Bar, this extraordinary consequence would follow,—that any rival of the patentee might prevent his obtaining a prolongation of the term of his patent by taking out a patent for a shorter term in a foreign country, the determination of which would absolutely preclude all right to a renewal, however great might be the merit, and however small the remuneration, of the original patentee. A construction leading to consequences so unreasonable and unjust ought not to be adopted unless the language of the Legislature imperatively requires it. Their Lordships, however, feel no difficulty in giving an interpretation to the Act more consonant with reason and justice. The earlier part of the 25th section clearly applies only to cases where patents have been granted in foreign countries before the grant of the patent in the United Kingdom, and the words in the proviso, "any such patent or like privilege," must be taken to refer to the entire description of the patents mentioned in the foregoing part of the section, and to no others This construction renders the section consistent throughout, and applicable in every part of it to the same subject. Where a patent is taken out in a foreign country before a patent for the same invention in the United Kingdom, the latter patent is to terminate at the same time as the foreign patent. Where the term in a foreign patent has expired, any grant of letters patent in the United Kingdom, made after that period, is to be of no validity.

This objection being disposed of, the claim of the petitioner to an extension of the term of his patent comes next to be considered. His invention is described with great precision and minuteness of detail in his specification; and the utility of it may be, in some degree, inferred from the strength of the opposition to his petition, but more especially from the extent to which the trade has been carried on by the petitioner. His opponents endeavoured, however, to diminish, if not to destroy, his merit, by producing a patent which had been granted to a person named Dobbs in 1804, by which they insisted the petitioner's invention had been anticipated.

Many of the questions directed to this subject appeared to be intended to impeach the validity of the patent for want of novelty. Their Lordships, in checking this inquiry, did not mean to intimate an opinion that if it could be clearly shown that a patent sought to be extended was bad for want of originality, they would still entertain the application; but merely that, in the present case, after what had previously occurred with respect to Dobbs' patent, a doubtful question of validity of the petitioner's patent could, at the utmost, be raised, which they would decline to determine.

It was alleged, however, that the inquiry respecting Dobbs' patent was directed, not to the novelty of the petitioner's invention, but to its want of merit. It will be necessary, therefore, shortly to consider the effect produced by Dobbs' patent upon the claim of the petitioner.

For the purpose of this application, it must he taken that the statement made of the nature of this patent in the House of Lords is accurate, viz., that Dobbs' specification disclosed no more than his notion that tin and lead might, by means of pressure, be so combined as to form a new and useful material. But that it gave uo information as to how that object could be obtained, aud that there was evidence to show that Dobbs had never been able, iu working accordiug to specification, to succeed in making the metals uuite.

Their Lordships think that this patent furnishes a good illustration of the distinction which was throwu out in the course of the discussion at the Bar, between the merit of iugenuity and the merit of utility. Dobbs' specification may have given the petitioner the idea of the possibility of uuiting the two metals of tin and lead, and may thus have deprived him of the merit of originality. But in Dobbs' hands the discovery was barren; the petitioner, however, who followed out his suggestion, and after repeated experiments gave it a practical application, is the real henefactor to the public, and is entitled to claim that description of merit which constitutes oue of the grounds for extending the term of a patent.

The only remaining question is, whether the petitioner has received sufficient remuneration for his useful invention.

And here their Lordships have to complain of the very unsatisfactory manuer in which the accouuts have been presented to them, which has compelled them, in many particulars, to resort to conjecture where certainty ought to have been afforded. There can be no difficulty in a patentee begiuning from the first to keep a patent account distinct and separate from any other husiness in which he may happen to be engaged. He knows perfectly well that if his invention is of public utility, and he has not been adequately remunerated, he will have a claim for an extension of the origiual term of his patent. It is not, therefore, too much to expect that he should be prepared, when the necessity arises, to give the clearest evidence of everything which has been paid and received on account of the patent. In the present case it is said that the capsule business, the subject of the patent, was blended with the other business of the petitioner, carried on in the Wharf Road, and that it is impossible to distinguish them. This may be perfectly true at the present time, but it need not have been so if the petitioner had proceeded from the first upou a separate system of account-keeping. For want of this he has to resort to speculation as to how much of the entire husiness ought to be ascribed to the patent, and to arrive at the conclusion by assuming as the basis of the calculation the amount of royalty which a licensee would he disposed to give.

Again, the petitioner has been involved in an enormous amount of litigation. which, of course, materially affects the profits which he has derived from his patent; but how much of the large sum of £20,800 is to be carried to the account of the patent, and how much belongs to other matters of litigation, he furnishes no meaus of ascertaining with precision.

It is quite clear that out of this large sum he would have to deduct the costs iu the action against Clifford, iu which he was unsuccessful. So from the sum of £6000, the expenses of the arbitration, a considerable deduction must be made, as the greater part of this lengthened inquiry must have arisen from the partnership disputes with the petitioner's brothers. Here again their Lordships are left to feel their way, where much more light might have been afforded them.

But making large deductions from the costs which the petitioner has placed to the accouut of the patent, their Lordships think they are justified in considering that the petitioner has not received a sufficient remuneration for an invention of great public utility; and they will, therefore, recommend to Her Majesty to grant him an extended term of five years from the termination of the original patent.

Capsule Metal: Betts *v.* Menzies.—This action was in the Court of Queen's Bench, before Lord Chief Justice Cockburn, and Justices Wightman, Blackburn, and Mellor. It is the great patent case, in which the House of Lords have recently given a decision of perhaps greater practical importance—not merely to that large class of persons, patentees of inventions, but to that still larger class so deeply interested therein, the commercial commuuity, and indeed it may be said the community at large; the point decided in substance being that not the man who originally, or as a matter of mere scientific theory or suggestion, hits upon some idea of the iuvention. but the man who first makes it commercially practicable and of practical value to the community, is entitled to patent it. The action was upon a patent obtained by Betts, the plaintiff, in January, 1849, "for a new manufacture of capsules, and of a material to be employed therein, and for other purposes." The action for its infringement by the defendant was brought in March 1857, and tried before Mr Justice Erle and a special jury in January 1859. It was proved that by following the directions contained in the plaintiff's specification a workman of ordinary skill could produce the manufacture therein described, and that the same was a useful and valuable article of commerce. It was set up on the part of the defendant that the plaintiff's invention, or some part of it, was included in the specification of a patent granted to one Dobbs, so long ago as the year 1804. On the other hand it was contended, on the part of the plaintiff, that it was impossible to ascertain the meaning of Dobbs' specification without evidence, and that its practical effect was for the jury upon such evidence; that Dobbs published nothing which could give any practical knowledge of the invention (which depended on the combinatiou of lead and tin), but that, on the contrary, that which he had published actually, instead of leading to the discovery, misled and led away from it, and that it was open to the defendant to prove all this by evidence before the jury, for them to determine thereon as to whether there had really been any practical discovery and disclosure of the invention by Dobbs, the alleged prior inventor. Mr Justice Erle in effect so held, and left the evidence to the jury, who found in favour of the plaintiff. There was then a rule for a new trial, on the ground that the verdict was against the evidence, or to enter the verdict absolutely for the defendant as a matter of law, on the ground that such evidence was not admissible, and that in law Dobbs' specification was a discovery, and destroyed the novelty of the plaintiff's invention. The Court of Queen's Bench made the rule absolute to euter the verdict, on the latter ground, for the defendant; the rule for a new trial, on the former ground, standing over. The Court of Error, in July, 1860, upheld this decision; but the House of Lords last Session reversed these judgments, and thus upheld the original directiou of the learned judge who tried the cause, Mr Justice (now Lord Chief Justice) Erle, and likewise affirming the correctness of a similar ruling by Mr Baron Bramwell on the trial of the great gaslight patent case—"Hills *v.* the London Gaslight Company." Pending this litigation, one of the Vice-Chancellors (Wood) had given the plaintiff an *interim* injunction; but, on the judgment of the Court of Error affirming that of the Court of Queen's Bench, his Honour dissolved that injunction, being of opinion that as wise judges had decided against the patent, it was not proper to continue the injunction merely because an appeal was pending to the House of Lords. And meanwhile, on the 8th of June, 1859, on the judgment of the Court of Queen's Bench being given in favour of the defendant, he signed judgment in the action. Afterwards the House of Lords reversed the judgment. Thereupon in this term Mr M. Smith, Q.C., on the part of the defendant, got a rule to re-enter the case on the new trial paper to have it argued on the ground which had been reserved—viz., that the verdict was against the evidence.

Counsel for the plaintiff obtained a rule to set aside this rule, on the ground that the defendant had already, by signing judgment and getting the injunction dissolved, obtained the benefit of his rule and put an end to it, and that he had now so altered the position of the parties that he was no longer entitled to revive it.

Counsel for the defendant, showed cause against this rule, and argued in support of his original rule to restore the case to the new trial paper, and have it re-argued on the effect of the evidence.

It was then argued for the plaintiff in support of the rule to rescind the former rule, and prevent the case from being restored and re-argued.

The effect of this would, of course, be to re-open this long litigation and give the defendant another chance of defeating the patent. The rule, therefore, although technical in its form, yet, as it practically involved at all events the possibility of such a result, was argued with the utmost keenness and tenacity on both sides, especially on the part of the plaintiff, whose counsel found themselves put in peril of losing the fruit of their hard-won victory. They urged with great force that the result of a new trial on the ground that the verdict was against the evidence was not final, but sent the parties to a new trial, there to re-open a long career of litigation upon all manner of new points. The plaintiff, they said, had considered that when the judgment was signed so long as June, 1859, the case was disposed of, subject only to the appeal to the Lords.

At the close of their arguments,

The Court (except Mr Justice Mellor, who, having been counsel in the case, withdrew) appeared to be impressed with this view, and thought that, as it appeared that the defendant himself had treated the judgment as final, and had got all the benefit of it, it would not be just now to allow him to re-open the litigation. It was plain, they said, that he had relied on the judgment of the Court below, and on the result of the appeal to the House of Lords.

On the other hand, it was urged, with great force, that this Court, in the time of Lord Campbell, in putting off the argument on the effect of the evidence, implied that, at a future period, the defendant was to have the benefit of it; that, as to the judgment, every judgment was final until it was reversed; and that, as to the decision of the Vice-Chancellor dissolving the injunction, it went not on the supposed finality of the judgment, but on the weight to be given to the opinions of nine judges.

The Court, however, pointed out that after the defendant had got the effect of the evidence reserved he signed final judgment, and then got the injunction dissolved, and had thus for two years had the sale of articles which turned out, after all, to be made under the plaintiff's patent.

The defendant's counsel, however, to this answered that the injunc-

tion was dissolved on the condition of an account being kept of the sales, the proceeds of which would be ultimately recovered by the plaintiff, and the position of the plaintiff had in no way been prejudiced. If the Vice-Chancellor had been at all misled, he would again impose the injunction.

At the close of the argument,

The Court—though with great doubt—said they thought that upon the whole there was no sufficient ground to deprive the defendant of his legal right to have the case re-argued upon the effect of the evidence. They had little doubt that the defendant had meant to treat the judgment as final, and had not intended to "have two strings to his bow," and reserve the effect of the evidence, but relied rather on the probability of the judgment of this Court and the Court of Error being affirmed by the House of Lords. As, however, they did not think that the plaintiff had been at all prejudiced, and were of opinion that the Vice Chancellor would have taken the same course had all the facts been before him as they now stood, they could not interfere to prevent the case being re-argued on the evidence.

It was intimated that the mere reading of the evidence (the case having taken six days to try) would take so long a time that the case must be put off till next term.

Registration of Assignment of a Patent: Corbett *v.* Leonard.—This was in the Court of Common Pleas, before Lord Chief Justice Erle, and Justices Williams, Byles, and Keating, when Counsel showed cause against a rule calling on the defendant to show cause why a register of an assignment of a patent, registered on the 17th of January, 1860, but taken to be registered on the 1st of January, should not be antedated as of the 1st of January, a subsequent assignment of the 10th of January having been registered on the 10th, and thus defeating the plaintiff's rights. After hearing the learned counsel at considerable length,

The Court made the rule absolute.

Chenille Fabrics: Davenport *v.* Jepson,—Injunction.—This was a motion in the Vice-Chancellor's Court, before Sir W. P. Wood, for an injunction to restrain the defendant from infringing certain patents for improvements in the manufacture of chenille and other piled fabrics vested in the plaintiffs, who were chenille manufacturers at Derby.

The motion was resisted by the defendant, upon the several grounds that the patents under which the plaintiffs claimed, were bad for want of novelty, and bad from vagueness in the specification; that the process of making chenille by machinery had been in operation before the first of the plaintiffs' patents had been obtained; and lastly, that there had been no infringement by the defendant, whose machinery was different in many important particulars.

A great quantity of evidence was adduced, and the various processes, which it would be difficult, if not impossible, to render intelligible without the aid of models, were exhibited in court by machinery. It appeared that the defendant, after receiving a notice from the plaintiffs that he was infringing their patents, had applied to them for licenses for the manufacture and sale of chenille. The plaintiffs, who were themselves manufacturers, declined to grant a license, and threatened proceedings against the defendant, at the same time asking for an inspection of his machinery. The defendant having declined to allow an inspection, the present bill was filed to restrain the alleged infringement.

At the opening of the motion some discussion arose as to whether the motion for an interlocutory injunction should proceed, the defendant contending that the case could not be decided upon the present materials, and that from the questions raised as to the validity of the patent the intervention of a jury would be necessary at the hearing of the cause, until which time the plaintiffs might well wait without being seriously injured (even if ultimately successful), while the expense and loss of time in hearing the case twice over would be thus obviated The plaintiffs, however, insisted upon their right to proceed with the motion.

Mr Wilcock, Mr Hardy, and Mr T. Webster appeared in support of the motion; Mr Rolt, Mr Karslake, and Mr Ashton (common law bar) were for the defendant.

The Vice-Chancellor said that the injury to a patentee who found his trade damaged and his custom diminished by the appearance in the market of an inferior article could hardly be exaggerated. In such a case the mere keeping an account by the defendant in the meantime until the hearing, did not in any way compensate the patentee for his loss in having the fruits of his patent taken from him. The remedy by interim injunction was that which best met the justice of the case, and he was not tempted to relax the rule enabling the Court to exercise this jurisdiction. His Honour, after adverting to proceedings by the plaintiffs, both in this court and at common law, against one Rickard, in which they had succeeded in establishing the validity of their patent, proceeded to comment upon the evidence which had been adduced by the defendant for the purpose of invalidating the patent. He confessed that that evidence carried very little weight to his mind as against the patent, or the proceedings at common law, in which upon the question of the validity of specification, the plaintiffs, after a protracted litigation had been successful. The validity of the patent might still be a question for argument at the hearing; but, looking at the long possession and enjoyment by the plaintiffs, the acquiescence in that enjoyment by the public, the effectual assertion by the plaintiffs of their rights as soon as any invasion was discovered—under all these circumstances, he did not think that he ought to refuse the injunction, which would be granted upon the usual undertaking by the plaintiffs to be answerable in damages.

Blasting Cartridges: Copeland *v.* Webb.—Injunction.—This was a motion in the Vice-Chancellor's Court, before Sir R. T. Kindersley, for an injunction to restrain the defendant from making blasting cartridges, manufactured on the same principle as that for which the plaintiff had obtained a patent. Plaintiff's specification stated that he claimed as his invention the employment of a waterproof textile material for the tubes or cases of cartridges containing the charge of gunpowder used by miners and quarrymen in blasting operations. He also claimed the employment of a tuft of cowhair, wool, feathers, loose-woollen fabric, or like elastic substance as a wadding between the cartridge and the tamping iron. It was alleged by the plaintiff's affidavits that the defendant had imitated the plaintiff's invention to the extent of making bags of waterproof material for the purpose of being used by the miners for blasting cartridges, and that he also sold with these bags a tuft of cowhair for the same purpose as that adopted by the plaintiff. The plaintiff's cartridges were varnished over with india-rubber, gutta-percha, or any other well-known material for resisting water, whereas the defendant's bags were made of a macintosh waterproof material, which, as he alleged, required no varnishing to be waterproof.

Mr Bailey and Mr Elderton appeared in support of the injunction.

Mr Cotterell, for the defendant, contended that, as the defendant in this case had also obtained a patent for his invention, the Court could not interfere between two patentees. The legal rights of the parties might be tried at law. There was nothing new in the invention of the principle upon which the plaintiff made his cartridges. It was no new thing to make waterproof bags for holding blasting powder, the only novelty consisted in the application of the principle to the construction of cartridges. The plaintiff's patent was for the complete manufactured cartridge, and not for the bags, and as this was the only part of the plaintiff's invention which the defendant had sold, there could be no cause for granting the injunction. As for the tuft of cowhair, that was used by the defendant for preventing sparks communicating with the powder improperly, and therefore it had a totally different object from the elastic material used by the plaintiff Besides this, the plaintiff had delayed so long in coming to the Court that he was not now entitled to an injunction.

The Vice-Chancellor said this was a case which he should certainly have sent to be tried by a court of law, if the recent statute had not prevented him from doing so. It appeared that both the plaintiff and defendant had obtained a patent for doing what he could not help seeing was precisely the same thing. It was not, therefore, for this Court to interfere and prevent either of them from doing what he had a right to do by the act of the Crown. He should certainly not grant any injunction upon an interlocutory application. If the defendant's patent could not stand with the plaintiff's, then the plaintiff ought to take steps to set it aside, which he might do by means of a *scire facias*. He could not help feeling, also, that a question might be raised as to the validity of the plaintiff's patent, and under all the circumstances he thought the best course was to put the defendant upon an undertaking to keep an account of what cartridges were sold by him, and to direct that the matter should stand over until the hearing.

REGISTERED DESIGNS.

NEEDLE PLATE FOR SEWING MACHINES.

William Newton Wilson, *of* 144 *High Holborn, Sewing Machine Maker, Proprietor.*

The purpose of utility to which the shape and configuration of the new parts of this design has reference is the obtainment of a more convenient support for the fabrics when stitching what are known as goffered trimmings, without involving the flattening of the same, as would be the case if the ordinary cloth plate were employed, whilst, at the same time, facility is afforded for making the ornamental chain, or loop

stitch (when using a sewing machine of that class) upon the right side of the trimming. Fig. 1 of the subjoined engravings represents a front elevation of so much of a chain stitch sewing machine as is requisite to illustrate the appearance of this design. Fig. 2 is a corresponding side elevation of the same, showing the trimming being stitched; and fig. 3 is a perspective view of the "needle plate," drawn to a larger scale, and detached. A is the novel form of "needle plate," consisting of a narrow strip of metal provided with a slot in it at *a*, for the feeder to work through. The narrow form of this needle plate allows the edges of the trimming to overhang, as shown in fig. 2, in lieu of being supported on a cloth plate. This needle plate is fixed by means of a screw, at *b*, to any convenient part of the machine.

Fig. 1.

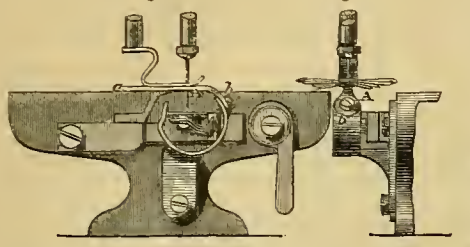


Fig. 2.

Fig. 3.

The only part of this design which is new and original in shape or configuration is that marked A, *a*.

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CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

THE STEAMSHIP *GREAT EASTERN.*

The following letter regarding the *Great Eastern*, which has been addressed to Messrs Rowland and Aspinwall of New York, has reached us for publication :—

In conformity with your request, I yesterday visited the steamship *Great Eastern*, anchored off White Stone, for the purpose of examining the nature and extent of the injuries received by her, in her late collision with a submerged rock, and the character of the repairs rendered necessary and in progress in consequence of that collision—and having discharged this duty, I submit the following report :—

Upon my arrival I examined the hull externally above water and within board, to ascertain if it gave evidence of any unresisted stress since my survey of her upon a previous voyage. Having satisfied myself upon this point, I descended from without the hull to within the coffer inclosing the rupture in her bottom, and also from within the hull between the outer and inner plating, again down to the place of rupture, being by this proceeding enabled to examine the full extent of the injuries to the bottom of the hull covered by the coffer and the character of the repairs being made thereto, and upon a full consideration of the elements presented, I am of the opinion :

1st—That the effect of the collision is restricted to a partial crushing of two of the webs and rupture of some of the outer plates of her bottom, upon the port side, and that the hull of this vessel—beyond the points of rupture, above water and within board—is in no wise injured by the collision.

2d—That the repairs to her bottom, so far as made, have been executed in a manner to restore it to its original security as to leaks and resistance to stress, and that the design both of the method of effecting these repairs and the manner of executing them, reflect high credit on all concerned.

In connection with this, it is proper to refer to the construction of the bottom of the vessel, in order that it may appear how peculiarly adapted it is to meet an injury like that which has occurred to it.

Thus, the bottom is composed of an outer and inner plating of equal thickness, with an intervening space of thirty-five inches, the connection between the platings consisting of thirty-two webs or keelsons running fore and aft, and thirteen athwart ships, whereby the bottom is divided into a series of apartments or cells, the communication between them being at command, and from within board by the use of man-hole plates.

In the event, therefore, of the outer plating alone being ruptured, as in the present case, the inner plating will resist the admission of water within the hull, and the cellular structure of the whole will resist the admission of water between the platings, beyond the limits of the cells inclosing the rupture.

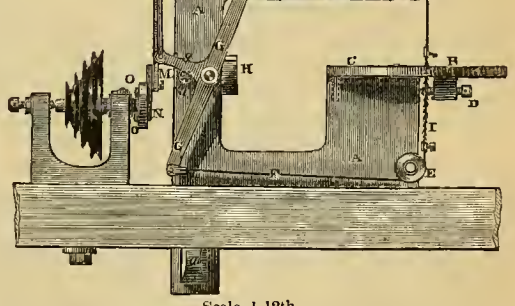
In communicating the result of my survey to the Underwriters here and to Lloyd's, London, I shall report her seaworthiness—provided the repairs now in advanced progress are completed—to be of the same character as before the collision which has involved them.

CHAS. H. HASWELL,
Engineer and Surveyor of Steamers.

New York, *December*, 1862.

I send you a short description of a bull-cutting machine which I have lately designed and applied to my lathe. It has proved most useful, and works well. The stroke of the saw can be varied from zero to the whole length of the saw, which is about 4 inches ; the speed, of course, depending on the diameter of the pulley on which the driving band is for the time being running, and the length of stroke is four times that of the eccentricity of the crank pin and twice that of the short arm of the lever. The subjoined engraving is a front elevation of the driving head stock and bed of the lathe, with this portable tool, shown as attached to it when working.

The frame of the machine, A, is firmly secured to the bed of the lathe by a wedge, *a*, and the table, B, on which the work is traversed is circular, and is attached to the frame by the screw stud, C, on which it swivels. The table being firmly fixed in any position required by the pinching screw, D. The two grooved pulleys, E, carry the thin steel bands, F, which are jointed to the vibrating lever, G. This lever has a short arm, *g*, forming part of it. The whole lever is centred on a stud in the slide, H, which is capable of being moved so as to stretch the saw, I, which is carried by the clamps on the ends of the bands, F. When the saw, I, is sufficiently stretched, the slide, H, is tightened up by the screw, *h*, at the back. The forked lever, K, centred at L, is connected on the near side, to the arm, *g*, by a rod, and on the further side of the lever, K, is attached by a ball and socket joint to the connecting, M, which is driven by a stud on a slide, N, of the chuck, which can be adjusted to give any required throw to the rod, M, by means of the tightening screws, O, in the back of the chuck.



Scale, 1-12th.

The saw cuts very cleanly and rapidly, having little or no vibration when driven at the highest speeds, while it is most portable, and can be dismounted from the lathe in a minute. If you think this will be acceptable to your readers, I shall be glad if you can spare it a place in your valuable *Journal*. T. E. MERRITT.

Rochester, December, 1862.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION.

Section C.—Geology.

October 2.

The President inquired how the variations of the surface called mountains, hills, cliffs, glens, valleys, and plains were formed. He took, first, the formation of great plains, and showed that although some were formed as plains on horizontal beds, few even of these retained the original surface of the position, but had more or less a denuded surface. Many equally level plains were low and level, because mountainous masses of rock, often greatly disturbed and contorted, had been removed from above the present surface. The central plain of Ireland, and other plains in the British Islands, were formed in this way. All mountains, except volcanoes or "hills of ejection," were either "hills of circumdenudation," formed by the wearing down and removal of the rocks formerly around them, or "hills of uptilting." In the latter, the lowest rocks appeared in the central part of the chain, often reared into the highest peaks; and these central beds dip on either hand under higher and higher groups, which come in as we recede from the axis of the chain. The beds have been raised by mechanical force acting from below; but this, however it had tilted or bent them, could not remove them, so that the successive exposure of lower and lower beds as we approach the axis of the chain must be owing to the external erosion of moving water. He then examined these forces of erosion; and while he attributed to marine action all the greater and more general features, the great plains, the long escarpments, and general outline of the mountains, he believed that the valleys which traversed the plains, the gullies that furrowed the sides of the hills, and the glens and ravines on the flanks of the mountains, were all due to the action of the ice or water which fell on them from the atmosphere. He did not give these views as altogether original, but mentioned M. Charpenteir and Mr Dana as having long ago applied them to the Pyrenees and to the Blue Mountains of New South Wales; but, having been long sceptical as to their reality, he now wished to record his conviction of their truth. Mr Prestwich, Prof. Ramsay and himself, while pursuing different lines of investigation, had all been simultaneously compelled to appeal to sub-aërial action as the only method of explaining the phenomena they had met with; and Dr Tyndal had since fallen into the same line of march.

"On a Whittled Bone from a Barnwell Gravel," by Mr H. Sheely.

"On a Deep Well at Norwich," by J. Crompton, Esq.

"On a Tertiary Bituminous Coal in Transylvania, with some notice on the Brown Coals of the Danube," by Professor Ansted.

"On an Ancient Sea-Beach and Bed at Fort William," by Mr J. G. Jeffreys.

October 3.

"On the Wokey Hole Hyæna-den," by Mr W. Boyd Dawkins.—Mr Dawkins described the peculiar features of the den—its accidental discovery, it being filled up to the roof with *dèbris*, stones and organic remains—and showed the evidence of human occupation. In three areas in the cave he found the ashes of bone, and especially of the *Rhinoceros tichorhinus*, associated with flint and chert implements of the same type as those of Amiens and Abbeville, and to those of the south-west of England. They were, however, of ruder workmanship, and possibly are of an earlier date. They were found underlying lines of peroxide of manganese, and of comminuted bone, and overlying in one of the three areas remains of the hyena, which mark the old floors of the cave. From this he inferred that "man, in one of the earlier, if not the earliest stages of his being, dwelt in this cave, as some of the most degraded of our race do at present; that he manufactured his implements and his weapons out of flint brought from the chalk downs of Wilts, the least fragile ohert of the greensand of the Black-down hills, and arrow-heads out of the more easily-fashioned bone.

"On the Last Eruption of Vesuvius," by Dr Dauheny.

"On an Extinct Volcano in Upper Burma," by Mr W. T. Blanford.

"On the Comparative Structure of Artificial and Natural Igneous Rocks," by Mr H. C. Sorby.

"On the Skiddaw Slate Series," by Professor Harkness.

"Contributions to Australian Mœsozoic Geology," by Mr C. Moore.

"On the Co-relation of Slates and Limestones of Devon and Cornwall with the Old Red Sandstone of Scotland," by Mr W. Pengelly.

October 4.

"On the Gold-fields of Auckland, New Zealand," by Dr L. W. Lindsay.

"On the Gold-fields of Otago, New Zealand," by Dr L. W. Lindsay.

Exhibited and Described the Tooth of a Mastodon, from Tertiary Marls, near Shanghai, China, by Professor Owen.

"On the Cause of the Difference in the State of Preservation of different kinds of Fossil Shells," by Mr H. C. Sorby.

"On the Identity of the Upper Old Red Sandstone with the Uppermost Devonian (the Marwood Beds of Murchison and Sedgwick), and of the Middle and Lower Old Red with the Middle and Lower Devonian," by Mr J. W. Salter.

Exhibited a Skull of the *Rhinoceros tichorhinus*, by Mr S. P. Saville.

October 6.

"Supplementary Report on Slaty Cleavage—Theoretical Considerations," by Professor Phillips.

"Preliminary Report of the Committee for Investigating the Chemical and Mineralogical Composition of the Granite of Donegal, and the Associated Rocks," by Dr T. Sterry Hunt.

"On Ossiferous Caves in Malta, explored by Capt. Spratt, R.N., with an Account of *Elephas Melitensis*, a pigmy species of Fossil Elephant, and other Remains found in them," by Dr Falconer.

"On the Glacier Phenomena of the Valley of the Upper Indus," by Capt. Godwin-Austen.

"On the Diluvial and Alluvial Deposits of Central Germany, and on the Climate of the Period," by Dr K. von Seebach.

"On the Fossils of the Boulder-clay in Caithness," by Mr C. W. Peach.

"Notice of some Mammalian Remains from the Bed of the German Ocean," by Mr C. B. Rose.

"On Specimens of Flint Implements from North Devon," by Rev. J. Dingle.

Exhibited, Flint Implements from Abberville and Amiens, by Dr Daubeny.

Exhibited, some Flint Implements from Amiens, by the Rev. G. T. Bonney.

Exhibited, Flint Implements from Hoxne, by Mr Doughty.

Exhibited, some Models of Foraminifera, by Dr Fritch.

October 7.

"On Bituminous Schists and their Relation to Coal," by Professor Ansted.

"On the Palæontology of Mineral Veins, and the Oolitic Age of some of the Mineral Veins in the Carboniferous Limestone," by Mr C. Moore.

"On the Fossil Feathered Animal (Griphosaurus of Wagner, Palæopteryx of Von Meyer) found in the Lithographic Slate of Pappenheim," by Professor Owen.

"On a New Form of Recent Echinoderm, and its probable Palæontological Affinities," by Dr Allman.

"On the Origin and Mode of Occurrence of the Petroleum of North America," by Dr T. S. Hunt.

"On the Structure and Origin of certain Limestones and Dolomites," by Dr T. S. Hunt.

"On the Gold-bearing Strata of Merionethshire," by Mr T. A. Readwin.

"On the Geology of a Part of Sligo," by Mr A. B. Wynne.

"On the Six-inch Geological Maps of the Burren District, County Clare, Ireland," by Mr. F. J. Foot.

"On a Plesiosaurus from the Lias of Whitby," by Dr A. Carte and Mr W. N. Baily.

"Report of a successful Search for Flint Implements in a Cave called 'The Oyle,' near Tenby, South Wales," by Mr G. N. Smith.

"On some Scutes of the Labyrinthodon, from the Keuper Bone-Breccia of Pendock, Worcestershire," by the Rev. W. S. Symonds.

"On New Fossil Fishes from the Old Red Sandstone of Caithness," by Mr C. W. Peach.

Section D.—Zoology and Botany, including Physiology.

October 2.

Professor Huxley, the President, described the nature and objects of the science, subdividing into the four heads of morphology, physiology, distribution and ætiology, or investigation of the laws which concern the origin, development and extinction of all organic beings. He narrated the history and progress of each branch, and specially adverted to the fact that almost all the valuable progress had been made during the last fifty years. In the lifetime of the present generation he anticipated a still more brilliant progress. Mr Darwin's name was received with applause. Professor Huxley affirmed that Mr Darwin's work was as perfect in its logical method as it was accurate in its scientific facts. He appealed to the Universities at Oxford and Cambridge no longer to confine their fellowships and the other great advantages of their endowments to success obtained in classics and mathematics. He trusted that before long biological science would receive a practical recognition in both Universities.

"On the Inflorescence of Plants," by Mr J. Gibbs.

"On two Aquatic Species of Hymenoptera, one of which swims with its wings," by Mr J. Lubbock.

"Exhibition of a Specimen of *Astarte compressa*, having its hinge-teeth reversed," by Mr J. Jeffreys.

"On the Toot-poison of New Zealaud," by Dr W. Lauder Lindsay.

"On the Influence of the Conditions of Existence in modifying the Characters of Species and Varieties," by the Rev. W. N. Molesworth.

October 3.

"Experiments with the seed of Malformed Roots, and on the Ennobling of Roots, with particular reference to the Parsnip," by Mr J. Buckman.

"Recent Experiments on Heterogenesis, or Spontaneous Generation," by Mr J. Samuelson.

"On the Zoological Significance of the Brain and Limb Characters of Man, with Remarks on the Cast of the Brain of the Gorilla," by Prof. Owen.

"On the Homologies of the Bones of the Head of the *Polypterus niloticus*," by Professor R. Owen.

"On the Characters of the Aye-aye, as a test of the Lamarckian and Darwinian Hypothesis of the Transmutation and Origiu of Species," by Professor R. Owen.

"Observations of the Habits of the Aye-aye living in the Gardens of the Zoological Society, Regent's Park, London," by Mr A. D. Bartlett.

"On Ribs and Transverse Processes, with special relation to the Theory of the Vertebrate Skeleton," by Dr Clelland.

"On the Structure of Corymorpha," by Professor Allman.

October 6.

"On the Change of the Form of the Head of Crocodiles; and on the Crocodiles of India and Africa," by Dr Gray.

"Report on the Mercantile Marine," by Dr Collingwood.

"On Geoffrey St-Hilaire's Distinction between Catarrhine and Platyrrhine Quadrumana," by Dr Collingwood.

"A Suggestion for the Physiological Classification of Animals," by Mr J. Hinton.

"On a New Form of Echinodermata," by Professor Allman.

"On Zoological Provinces," by Sir J. Richardson.

"On Marriages of Consanguinity," by Dr G. Child.

"On the Production of similar Medusoids by certain Hydroid Polypes belonging to different Genera," by the Rev. T. Hinks.

"On the Generative Zooid of Clavatella," by Professor Allman.

"On some New British Tubularide," by Professor Allman.

"Report on the Reproduction of the Hydroida," by Professor Allman.

October 7.

"Report of the Dogger-Bank Dredging Expedition," by Mr H. T. Mennell.

"Report of the Committee for Dredging on the North and East Coasts of Scotland," by Mr J. G. Jeffreys.

"On a Species of Limopsis now living in the British Seas, with Remarks on the Genus," by Mr J. G Jeffreys.

"On the Cultivation of the Salmon Fisheries," by Dr Davy.

"On the Occurrence of *Asplenium viride* on an Isolated Travertine Rock among the Black Mountains of Monmouthshire," by the Rev. W. S. Symonds.

"Notice of some Objects of Natural History lately obtained from the Bottom of the Atlantic," by Professor W. King.

To Exhibit a Botanical Chart of the Barony of Burren, County Clare, by Mr F. J. Foot.

"Remarks upon the Natural History of the Herring," by the President.

"Notes on *Sphærularia Bombi*,' by Mr J. Lubbock.

"Reply to the Remarks of Mr F. Marcett on the Power of Selection ascribed to the Roots of Plants," by Dr Daubeny.

Sub-Section D.—Physiology.

October 2.

"On the Study of the Circulation of the Blood," by Dr G. Robinson.

"On Simple Syncope as a Coincidence in Chloroform Accidents," by Dr C. Kidd.

"On the Physiological Effects of the Bromide of Ammonium," by Dr G. D. Gibb.

"Observations on the Earth-Worm," by Dr J. Davy.

October 3.

"Remarks on all the known Forms of Human Entozoa," by Dr T. S. Cobbold.

"On Tobacco Smoking: its Effect upon the Pulsation," by Dr Smith.

"On the Question whether Arsenic taken for lengthened Periods in very minute Quantities is Injurious," by Dr. J. Davy.

"On Secret Poisoning," by Professor Harley.

"On the Difference of Behaviour exhibited by Inuline and ordinary Starch when treated with Salivary Diastase and other converting Agents," by Professor Rolleston.

"Observations made at Sea on the Motions of Vessels, with reference to their Effects in producing Sea-Sickness," by Mr J. W. Osborne.

October 4.

"On the Function of the Auricular Appendix of the Heart," by Mr I. Ashe.

"On the Functions of the Oblique Muscles of the Orbit," by Mr I. Ashe.

"On the Normal Position of the Epiglottis as determined by the Laryngoscope," by Dr G. D. Gibb.

"Remarks on the Loss of Muscular Power arising from the ordinary Footclothing now worn, and on the means required to obviate the loss," by Mr J. Dowie.

"An Attempt to show that every living Structure consists of Matter which is the Seat of Vital Actions, and Matter in which Physical and Chemical Changes alone take place," by Professor Beale.

"A Tabular View of the Relation which subsists between the Three Kingdoms of Nature with regard to Organization," by Mr H. Freke.

"On an Albino Variety of Crab; with some Observations on Crustaceans, and on the Effect of Light," by Mr R. Garner.

"On the Termination of Motor Nerves, and their connexion with Muscular Contractions," by Professor W. Köhne.

October 6.

"Some Observations on the Vitality of Fishes as tested by the Increase of Temperature," by Dr J. Davy.

"Some Observations on the Coagulation of the Blood in relation to its Cause," by Dr J. Davy.

"On Pearls: their Parasitic Origin, by Mr R. Garner.

"On Tobacco in Relation to Physiology," by Mr T. Reynolds.

"On the Skull Sutures, and their Relation to the Brain," by Mr R. Garner.

Section E.—Geography and Ethnology.

October 2.

"Ascent of the Cameroons Mountains, West Africa," by Capt. R. Burton.

"On Colour as a Test of the Races of Man," by J. Craufurd, Esq.

"Letter from Eastern Africa," by Dr Livingstone.

"On the Proceedings of the United University Missions," by the Rev. H. C. Scudamore.

"Voyage on the Lake Nyassa, Eastern Africa," by the Rev. Mr Stewart.

"On the Trans-Indus Frontier of British India," by Major Walker.

October 3.

"On the Climate of Guernsey," by Professor Ansted.

"On Vancouver's Island," by Commander Mayne.

"An Account of the Veddahs of Ceylon," by Mr J. Bailey.

"A Journey to Harran in Padan-Aram, and thence over Mount Gilead into the Promised Land," by Dr C. T. Beke.

"Ascent of Um Shaumur, in the Peninsula of Sinai," by the Rev. G. Prout.

"On the Middle Island of New Zealand," by Mr J. Rochfoot.

October 4.

"On the Civilization of Japan," by Sir R. Alcock.

"On serious Inaccuracies in the Great Survey of the Alps, south of Mont Blanc, as issued by the Government of Sardinia," by Mr W. Mathews.

"On the Yang-tze-Kiang River, China," by Lieut. Col. Sarel.

"On the Eastern Archipelago and New Guinea," by Mr A. R. Wallace.

October 6.

"On Terrestrial Planispheres," by the Chevalier Ignazio Villa.

"Decipherment of the Phœnician Inscription on the Newton Stone, Aberdeenshire," by the Rev. Dr Mill.

"Recent Letter on the Death of his Wife," by Dr Livingstone.

"On Language as a Test of the Races of Man," by Mr J. Craufurd.

"Report on the Human Remains found in the Course of the Excavations at Wroxeter," by Mr T. Wright.

"On the Geography of Bread Plants," by M. Michelsen.

October 7.

"On the late Explorations in Australia, by Burke and Wills, Gregory, &c," by Sir C. Nicholson.

"Some Observations on the Psychological Differences that exist among the Typical Races of Man," by Mr R. Dunn.

"Exploration dans l'Afrique centrale, de Serre-Leone à Alger, par Timbuctu," by M. J. Gérard.

ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, MANCHESTER.

The Monthly Report presented at this meeting by Mr Fletcher, chief engineer, states that during the past month there have been examined 365 engines and 547 boilers. Of the latter 8 have been examined internally, 60 thoroughly, and 479 externally, in which the following defects have been found:—Fracture, 5 (1 dangerous); corrosion, 38 (3 dangerous); safety-valves out of order, 13; water gauges ditto, 31; pressure gauges ditto, 9; feed apparatus ditto, 6; blow-off cocks ditto, 47 (1 dangerous); fusible plugs ditto, 3; furnaces out of shape, 6 (2 dangerous); blistered plates, 3; deficiency of water, 1. Total, 162 (7 dangerous). Boilers without glass water gauges, 10; without pressure gauges, 2; without blow-off cocks, 38; without back pressure valves, 78.

An explosion has occurred this month to the boiler of a first-class passenger locomotive engine, by which three persons were killed and others injured. It was considered to be perfectly safe, had been on duty the previous day, and was being cleaned ready for work at the moment the explosion occurred.

It will be remembered that reference was made in the July, 1861, report, to another explosion of a locomotive boiler, which took place while the train was running; and since that time three others have occurred in addition to the one first alluded to, thus making five during that period with this class of boiler.

The cause of explosion in four of these cases proved to be thinning of the plates from internal corrosion. I have only had an opportunity of examining the plates of one of these exploded boilers, but from official reports, it appears that the corrosive action had developed itself in a very similar manner in each instance, which in the one personally examined was as follows:—The corrosion had eaten grooves or furrows parallel with and close to the edge of the overlaps of the plates, at some of the longitudinal seams of rivets; the furrows

being on the outer plates of the overlap, while the deepest one, and that from which the explosion had sprung, was situated nearly midway between the smoke box and fire box.

This furrowing action, will be at once recognised by those who have been in the habit of observing the influence of wear upon the ordinary internally fired double-flued boiler, in general use in Lancashire. In this boiler the furrow is found on the inner surface, both of the front and back end-plates, but more especially at the front, and lies close to the edge of the internal flue angle-iron, which it partially encircles; the furrow being deepest at the crown, and gradually dying out in about six or nine inches on each side. It is sometimes found in the root of the angle-iron itself; the choice of position between the plate and angle-iron, apparently depending upon their comparative power of resistance. When the plate of the furnace-tube is flanged, the furrow more frequently occurs at the springing of the flange than at the end-plate. Furrowing also is very commonly found at the transverse seams of rivets at the underside of boilers; the furrows in these cases being immediately at the edges of the overlaps, and most frequently on the external surface of the plates, but sometimes on the internal. This action is more severe in long boilers than in short ones, and at the middle of their length rather than at their ends. It is seldom, if ever, developed at the longitudinal seams of these boilers, except where leakage takes place, and is then found to be most severe when the objectionable plan of construction is adopted, of placing the seams of rivets in one continuous line from one end of the boiler to the other. Such are some of the manifestations of furrowing constantly met with in the boilers under the inspection of this Association, and it may be interesting to attempt to trace the cause.

Furrowing appears to be the result of corrosive and mechanical action combined. The mechanical action, such as an alternate buckling of the plates, strains and frets them, and thus renders them more susceptible to the influence of corrosion than the parts at rest. Where these furrows are internal, the corrosive element is furnished by the water, which is rarely, if ever, free from acidity; and when the furrows are found externally in the flues, as explained above, the corrosion may, perhaps, be attributed to the influence of the gases.

The cause of the buckling action varies according to the position in which it occurs.

In the stationary boilers above referred to, when found in the front end-plate, it may be ascribed to the alternate elongation of the internal flues, more especially at the furnace end; and, when at the bottom of the external shell, to the unequal expansion of the plates consequent upon the different strata of temperature in the water. The temperature of these strata varies with the distance from the bottom of the boiler, in proof of which it may be stated that it is frequently found that while the water is boiling on the surface, that, at the bottom of the boiler will not scald the hand. Those boilers are most conducive to this inequality of temperature which have a defective circulation of water, are so set that the last heat from the fires passes beneath them, and fed with comparative cold water introduced at the bottom. It will be readily seen how these varying temperatures induce unequal expansion of the plates, and thus put upon the seams of rivets most irregular and severe strains. In this way, it is thought that the buckling action is produced, which results in furrowing at the bottom of stationary boilers.

In locomotive boilers, the buckling at the longitudinal seams, in the cylindrical portion of the shell, arises from its not being of true circular from in the vicinity of the overlaps. The tendency of the internal steam pressure is to correct this, and to induce a true circular form, and thus a cross strain, which may be correctly termed a "girder strain," is put upon the plates at a short distance on each side of the line of rivets; from this a change of shape ensues, which constantly varies with the pressure of steam. The position of the furrows is found to be that of greatest elasticity, being midway between the fixed ends of the fire box and smoke box, just where this buckling action would have most play. It will at once be seen that the thicker the plates the greater the leverage of the girder action, and thus to thicken their edges is only to aggravate the evil. The true circular shape may be maintained, as far as appearance is concerned, by substituting a butt-strip for the overlap, but this, from its one-sidedness, will not prevent the girder action, and, indeed, tends to make two furrows instead of one. Were an inner as well as an outer butt-strip introduced, the parts would be in equilibrio, and the strain then passing through the centre of the plates, they would be subjected to their legitimate tensile strain only, and the buckling action in question set at rest.

But whatever expedients may be adopted to meet special cases, as one after another may force itself upon attention, some general precautionary measure appears to be needed to guard against the subtle influence of corrosion. It is often found, in a line of one hundred rivets, to attack ten and neglect the remainder; in an entire boiler, it will affect one or two plates and not the rest; and even in a series of boilers will select one in preference to the others. No doubt careful analysis might detect some predisposition in the metal, and thus account for the apparent anomalies, but the difficulty of foretelling the precise course of corrosion must be candidly acknowledged, and hence the necessity, as just stated, for the adoption of some sweeping precautionary measure, which will embrace every case without distinction.

The Association meets the difficulty with its own members by affording them the opportunity of having what is technically termed a "Thorough examination" of each of their boilers once a year, when all the seams as well as the surfaces of the plates, both outer and inner, are examined throughout, provided that the boiler is suitably prepared for the inspection. The conviction of the importance of these examinations—which such explosions as the one under consideration serve to deepen—may explain the frequency with which reference is made to this subject. Indeed, the Association cannot hold itself responsible for the safety of any of the boilers under its charge, where the opportunity of making an annual "Thorough examination" is withheld. In addition, it recommends to those members using multitubular boilers, that such an arrangement of tubes should be more generally adopted as will admit of a man's gaining access between them and the shell for the purpose of examination, while those should apply the hydraulic test annually, who are employing boilers which will not admit of complete examination.

From the experience derived from the boilers under the inspection of this Association, it certainly appears hazardous to allow locomotives to work, as is very usually done, for five or seven years, without a complete internal examination; and it, therefore, becomes most important, either that some searching test should be adopted that shall at all times ascertain the sufficiency of the boilers without removing the tubes, or else that their construction shall be so modified that the parts may be rendered accessible to complete examination. The occurrence of four explosions to locomotive boilers, from internal corrosion, within the last eighteen months, must show the necessity of taking this subject into serious consideration.

SETTING BOILERS.

Considerable difficulty is experienced in examining many boilers from the contracted area of the flues; some indeed are altogether inaccessible. Boiler setting appears to be left too much to the individual tastes of the bricklayer, and, consequently, flues of every variety of proportion are met with. A sketch has been drawn up of the proportions most generally approved, and at an early opportunity a description will be given—which space does not now permit—for the assistance of those who are re-setting their old boilers or laying down new ones; meanwhile, a drawing lies at the office of the Association for the inspection of members.

INSTITUTION OF CIVIL ENGINEERS.

NOVEMBER 18, 1862.—Discussion on Mr Crawford's paper "On the Railway System of Germany."

NOVEMBER 25, 1862.—"On the Hownes Gill Viaduct on the Stockton and Darlington Railway," by Mr W. Cudworth.

"On the Use of the Timber of the Palmyra Palm, in the Construction of Bridges," by Mr Henry Byrne.—It was stated that, in the tract of country at the northern extremity of Ceylon, known as the Jaffna Peninsula, a district embracing an area of about 400 square miles, of which the author had charge till recently, as resident or Assistant Civil Engineer, the only timber fit for building purposes was that of the Palmyra Palm. This palm grew perfectly straight to a height of 60 feet, and was of nearly uniform thickness, 10 inches, from a few feet above the ground. The lower half only, however, contained sufficient woody fibre to render it useful, and in good specimens this portion of the tree at a height of 30 feet was from 3 to 4 inches thick, or one-third the diameter of the stem, while at the base there was little or no pith. The specific gravity of the best portion of the stem was on an average 1.055, and its power of resistance to a transverse strain as compared with teak as 9 to 8. A well-grown tree would yield a pile 30 feet in length, requiring only to be stripped of its outer integument (sometimes, but erroneously, called the bark) and pointed to fit it for use. The author had never had occasion to use rings, to prevent it from splitting in the process of driving, while the nature of the ground was such as to render shoes unnecessary. For roadway bearers, the most efficient plan was to split the tree in half, and after removing the pith, to join the two pieces together by wooden keys, at intervals of 4 feet, and to set the beams on edge, when they would be 8 inches deep, and 6 or 7 inches thick. Five lines of such bearers, under a roadway 15 feet wide, and supported at intervals of 10 feet, were sufficient for the heaviest turnpike road traffic, including the largest elephant waggons. In every case the roadway bearers were supported directly by piling, the plan of strutting them from the piles, or of supporting them by iron tension rods, in order to allow of wider bays, being objectionable. The first method would involve either the weakening of the piles, by notching them to receive the struts, or the use of iron bolts and straps which corroded very rapidly in that climate, and injured the timber in contact with them. By the second plan, the safety of the structure would depend solely upon the iron, and would be a source of constant anxiety from the perishable nature of that material. Iron had only been used for spiking the planking to the roadway bearers, when it was protected from damp, by the concrete usually laid over the planking. As to the durability of such bridges, the first the author constructed had stood for sixteen years without requiring any material repairs. He believed that in the most unfavourable situations the average duration of a Palmyra timber bridge might be reckoned at twenty-five years; and even then a large proportion of the material might be used in the reconstruction of it. This timber seemed to be proof against the attacks of the teredo, and inferior specimens remained perfectly sound below the water line, while above it a coating of tar was all that was needed to prevent splitting from exposure to the sun. Details were then given of the actual cost of 20 lineal feet of a bridge constructed wholly with Palmyra timber, 300 feet in length and 15 feet wide, from which it appeared that the cost per lineal foot amounted to 16s 6d, and it was stated that some bridges had cost from 15 to 20 per cent less. In the district referred to, an aggregate length of about 2000 feet of such bridges had been built within the last few years, across the numerous tidal inlets which intersected it in various directions.

The Council of the Institution of Civil Engineers have awarded the following Premiums:—

1. A Telford Medal, the Manby Premium, in Books, and a Stephenson Prize of Twenty-five Guineas, to Charles Augustus Hartley, M. Inst. C.E., for his "Description of the Delta, and of the Works recently executed at the Sulina Mouth of the Danube."

2. A Telford Medal, and a Miller Prize of Fifteen Guineas, to John Henry Muller (of the Hague), for his paper "On Reclaiming Land from Seas and Estuaries."

3. A Telford Medal, and a Miller Prize of Fifteen Guineas, to John Paton, M. Inst. C.E., for his paper "On the Sea Dykes of Schleswig and Holstein, and on Reclaiming Land from the Sea."

4. A Telford Medal, to James Abernethy, M. Inst. C.E., for his "Description and Illustrations of the Works at the Ports of Swansea, Silloth, and Blyth."

5. A Telford Medal, to John Bailey Denton, M. Inst. C.E., for his paper "On the Discharge from Underdrainage, and its effect on the Arterial Channels and Outfalls of the Country."

6. A Watt Medal, to Joseph D'Aguilar Samuda, M. Inst. C.E., for his paper "On the Form and Materials for Iron-Plated Ships, and the Points Requiring Attention in their Construction."

7. A Council Premium of Books, to James Brunlees, M. Inst. C.E., for his paper on "Railway Accidents—their causes and means of prevention."

8. A Council Premium of Books, to Captain Douglas Galton, R.E., F.R.S., Assoc. Inst. C.E., for his Paper on "Railway Accidents, showing the bearing which existing legislation has upon them."

9. A Council Premium of Books, to Henry Charles Forde, M. Inst. C.E., for his Paper on "The Malta and Alexandria Submarine Cable."

10. A Council Premium of Books, to Charles William Siemens, F.R.S., M. Inst. C.E., for his paper "On the Electrical Tests employed during the construction of the Malta and Alexandria Telegraph, and on insulating and protecting Submarine Cables."

11. A Council Premium of Books, to James Atkinson Longridge, M. Inst. C.E., for his paper on "The Hooghly and the Mutla."

12. A Council Premium of Books, to James Oldham, M. Inst. C.E., for his paper "On Reclaiming Land from Seas and Estuaries."

The Council invite communications on the following, as well as other subjects, for Premiums.

For a limited number of papers of distinguished merit, pecuniary awards will be made, not exceeding in each case twenty-five guineas, in addition to the honorary premiums. The subjects numbered 14, 18, 28, and 41, have been selected as those upon which, it is hoped, such communications may be received during the ensuing session. But papers on other subjects, if of adequate merit, will be taken into consideration, in the adjudication of the pecuniary awards.

1. On the Decay of Materials in Tropical Climates, and the methods employed for arresting and preventing it.

2. On the Manufacture of Bricks by Machinery, and their comparison with hand-made bricks.

3. On the Methods of constructing Foundations, for large Structures, in deep water, and on the various systems of Driving Piles.

4. On the Construction of Suspension Bridges, with rigid platforms, and the plans of Anchoring the Stay-chains.

5. On the various modes adopted for Moving Earth in Tunnels, Cuttings, or Embankments, with the cost.

6. On the Mechanical Methods of Boring and of Sinking large Shafts, of introducing the tubbing and the impervious lining, and of traversing running sand and other difficult strata.

7. On the results of contrivances for facilitating the Driving of Tunnels, or Drifts in Rock.

8. On Locomotive Engines for ascending Steep Inclines, especially when in combination with sharp curves, on Railways.

9. On the Construction of Railway Carriages and Waggons, with a view to the reduction of the gross weight of Passenger and Goods Trains; also of Railway Wheels, Axles, Bearings, Axle-Boxes, and Breaks, and of Bearing, Traction, and Buffer Springs; treating particularly their ascertained duration and their relative friction.

10. On the Working Expenses of Railways, and the influence of the original design and construction.

11. On the Application of the Electric Telegraph to Railway Train Signalling.

12. On the Results of a series of observations on the Flow of Water from the Ground, in any large district; with accurately-recorded Rain-Gauge Registries, in the same locality, for a period of not less than twelve months.

13. On the Construction of Catch-water Reservoirs in Mountain Districts, for the supply of Towns, or for Manufacturing purposes.

14. Accounts of existing Water-works; including the source of supply, a description of the different modes of collecting and filtering, the distribution throughout the streets of Towns, and the general practical results. (Twenty-five Guineas.)

15. On the Drainage and Sewerage of large Towns; exemplified by accounts of the systems at present pursued, with regard to the level and position of the outfall, the form, dimensions, and material of the sewers, the prevention of emanations from them, the arrangements for connecting the house drains with public sewers, and the disposal of the sewage, whether in a liquid form, as irrigation, or in a solid form after deodorization.

16. On the Results of the Employment of Steam Power on Canals, and of other measures for the Improvement of Canals as a means of conveyance for heavy traffic.

17. A History of the successive changes of any Fresh Water Channel,—accompanied by plans and longitudinal and cross sections,—including a description of the drainage area, and the results of a series of consecutive gaugings, with tables of rainfall for a period of not less than twelve months, as well as notices of any works which may have been executed upon it, and of the effects of the works,—such as those relating to Land Drainage—Irrigation—Navigation—Compensation Reservoirs—Permanent and Moveable Dams—etc.

18. A History of any Tidal River, or Estuary—accompanied by plans and longitudinal and cross sections—including notices of any works which may have been executed upon it, of the relative effects of Tidal and Fresh Water, and of the effect of Enclosures from the Tidal Area upon the general regime, of Sluicing where applied to the improvement of the entrance or the removal of a Bar, and of Groynes or Parallel Training Walls. Also, of Dredging, with a description of the Machinery employed, and the cost of raising and depositing the material. (Twenty-five Guineas.)

19. On the Results of a Series of Tidal Observations, illustrative of the modifications which the tidal wave undergoes in its passage up and down a tidal river or estuary.

20. On the Construction of Tidal or other Dams, in a constant or variable depth of water.

21. A History of any Harbour, including the reasons for selecting the site, the mode of construction adopted, and the subsidiary works for the convenience of shipping, and for commercial purposes, with the cost, &c.

22. A History of any Refuge Harbour, including the reasons for selecting the site, the mode of construction adopted, its cost, and the time employed in its execution.

23. A History of any Dock, on the course of a Tidal Stream, in communication with Railways and with Inland Navigation, including the reasons for the selection of the site, the mode of construction adopted, the position of the entrance with reference to the direction of the stream, the cost, &c.

24. Descriptions of the various kinds of Machinery in use in the principal Shipping Ports, for the Shipment of Coal; noticing particularly those in which the greatest expedition is combined with the least amount of breakage of the Coal; and also accounts of the means of unshipping and measuring, or weighing the Coal, on its arrival in Port.

25. On the arrangement and construction of Floating Landing-Stages, for passenger and other traffic, with existing examples.

26. On the different systems of Swing, Lifting, and other opening Bridges, with existing examples.

27. On the Construction of Lighthouses, their Machinery and Lighting Apparatus; with notices of the methods in use for distinguishing the different Lights.

28. On the results of the use of Tubular Boilers, and of Steam at an increased pressure for Marine Engines, noticing particularly the difference in weight and in speed, in proportion to the Horse Power and the Tonnage. (Twenty-five Guineas.)

29. On the relative advantages of the Principal of Expansion, as applied in the Single long-stroke Cylinder Engine, in the Double Cylinder Engine, and in the Three Cylinder Engine; and on the adaptation of the two latter to marine purposes.

30. On the Causes of the alleged Failure in Economising Fuel in working Steam expansively, and the probable conditions for insuring success.

31. On the Results of the use of Superheated Steam, and of Surface Condensation.

32. On the Measure of Resistance to Steam Vessels at high Velocities.

33. On Boiler Inspection as practised in this Country and on the Continent, with remarks as to the comparative merits of the two systems.

34. On the construction of, and the comparative duty performed by, modern Pumping Engines for raising Water, for the Supply of Towns, or for the Drainage of Mines; noticing, in the latter case, the depth and length of the underground workings, the height of the surface above the sea, the geological formation, the contiguity of streams, &c.

35. On the Results of the use of Pumps of different kinds, for lifting large quantities of water to a limited height, for the purposes of Drainage, or of Irrigation.

36. On Turbines and other Water Motors of a similar character: their construction and performance, and comparison with Water-wheels.

37. On the means of Utilizing the products of the Distillation of Coal, so as to reduce the price of Coke; with descriptions of the Ovens, and of the best processes used in Great Britain and on the Continent, in the manufacture of Coke.

38. On the present systems of Smelting Iron Ores; and on the conversion of cast-iron into the malleable state, and of the manufacture of iron generally, comprising the distribution and management of Iron Works.

39. On the Chemical Analysis, and the application to economic purposes, of the Gases generated in Iron Blast Furnaces.

40. On the Manufacture of Iron for Rails and Wheel Tyres, having special reference to the increased capability of resisting lamination and abrasion; and accounts of the Machinery required for rolling heavy Rails, Shafts, and bars of Iron of large sectional area.

41. On the Manufacture of large Masses of Iron for the purposes of Warfare, as Armour Plates, &c. (Twenty-five Guineas.)

42. On the Construction of Rifled and Breach-loading Artillery; and on the Initial Velocity, Range and Penetration of Rifled Projectiles, and the influence of Atmospheric Resistance.

43. On the use of Steel Bars and Plates in Engine-work and Machinery, for Boilers and for Shipbuilding.

44. On Machinery adapted for the Better Separation of the various Substances found in Combination with Metallic Productions.

45. On the Substitution of Machinery for Manual Labour in Mining Operations; and on Hydraulic Machinery in Mines.

46. On the Precautions to be adopted for guarding against Accidents by Fire-damp and After-damp in Mines.

47. On the Improvements which may be effected in the Buildings, Machinery, and Apparatus for producing Sugar from the Cane in the Plantations and Sugar-works of the British Colonies, and the Comparison with Beet-root, with regard to quantity, quality, and economy of manufacture.

48. The uses of Vulcanized or Mineralized Caoutchouc; the means of increasing its durability, and the modes of causing its adhesion to metal.

49. On the application of Photography to Engineering.

50. Memoirs and accounts of the Works and Inventions of any of the following Engineers;—Sir Hugh Middleton, Arthur Wolfe, Jonathan Hornblower, Richard Trevithick, William Murdoch (of Soho), Alexander Nimmo, and John Rennie.

Original papers, reports, or designs of these, or other eminent individuals, are particularly valuable for the library of the Institution.

The competition for premiums is not confined to members or associates of the Institution, but is equally open to all persons, whether natives or foreigners.

The Council will not consider themselves bound to award any premium should the communication not be of adequate merit, but they will award more than one premium, should there be several communications on the same subject deserving this mark of distinction.

The communications must be forwarded, on or before the 1st of February, 1863, to the house of the Institution, No. 25 Great George Street, Westminster, S.W., where copies of this paper and any further information may be obtained.

December 2, 1862.—"On some of the Internal Disturbing Forces of Locomotive Engines," by Mr A. W. Makinson.—In concluding his paper, the author submitted, that a single-cylinder engine would be free from all sinuous motion: that at 26 miles an hour it would have about the same, and at higher speeds far less, fore and aft motion, than the ordinary two-cylinder engines: that by supplying the driver with the means of applying about as much power as was expended in putting the breaks on hard, a single-cylinder engine would have equal certainty of starting with the two-cylinder engine: and that the use of single-cylinder engines for passenger traffic would, by reducing the oscillation of the carriages, render railway travelling less unpleasant, and reduce the cost of locomotive power, and the expense of maintenance of way; whilst the dead weight of the engine, and the wear and tear of the several parts, would be diminished.

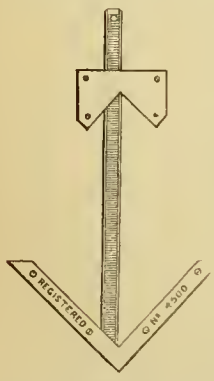
INSTITUTION OF ENGINEERS IN SCOTLAND.

November 26, 1862.—Discussion on Mr G. Simpson's paper "On Machinery for Boring Stratified and other Rocks."

"Experiments on Wrought Iron and Steel," by Mr D. Kirkaldy.

MONTHLY NOTES.

Universal Square.—Mr A. J. Hale, of William Street, Clerkenwell, has reecntly registered a little instrument, which will be found of great service in the workshop of the engineer, engraver, cabinet maker, or designer, and, indeed, to all who use the square. This "*universal* square," of which we annex an illustration, can be used either as an ordinary T square on the drawing board, or employed for dividing and finding the centres of ovals, circles, squares, or any equal-sided figure, without the aid of compasses, in a much more expeditious manner than can be accomplished by the existing modes. It is made for workshop use, of gun metal, and will, therefore, stand rough usage, and consists of a straight-edge, having secured at one end a rectangle, the extremity of the sides or arms of which serve as the guide when used as a T square, by bearing



against the side of the drawing board. The edge of the straight-edge or ruler portion coincides exactly with the apex of the rectangle, which it equally bisects, as shown in the illustration. Upon the blade of the straight-edge is fitted an adjustable slide, the inner edge of which is also cut so as to form a rectangle bisected equally by the edge of the blade. When used as an ordinary T square for drawing, this slide is unmoved, but when used for the purpose of finding the centre of a circular, or other regular or equal-sided figure, the slide is replaced, and the article which may be, say of an oval form, is laid upon the blade, and with one edge against the under sides of the larger rectangle, whilst the angle of the slide is brought to bear against the opposite side of the oval, the two angles serving to bring the oval into such a position that its major or minor axis, as the case may be, is brought exactly parallel with, and coincident to, the edge of the straight-edge, when, by ruling a line across the article along the straight-edge, the oval will be found to be equally divided into two parts. On again adjusting the position of the oval at right angles to the former position, the slide will perfect such adjustment; and a second line ruled across the figure will be found to be exactly at right angles to the former, and to bisect the oval equally. The intersection of the two lines gives the exact centre of the oval, which is thus equally divided into four parts. When operating upon a true circle, the diameter is immediately found by placing it between the sides of the larger angle, and by ruling a second diameter at or near right angles to the first, the intervention of the two lines will give the usual centre of the figure. There are many cases in which this instrument will be found of great assistance to the workman.

Armour Plates and Backing: The Achilles.—The number of hands now employed upon the *Achilles*, 1250 H. P., at Chatham dockyard, is close upon 900, 250 of whom are dockyard ship-wrights who have acquired sufficient knowledge of iron ship-building to justify their being employed on the new iron frigate. The midships portion of the iron-plates, or skin of the vessel, having all been riveted, the operation of fixing the teak backing, on which the exterior armour plates will be laid, has been commenced. Between the inner and outer plates of the vessel's side will be laid a backing of teak 18 inches in thickness, composed of two planks, the 10-inch baulks of timber being fixed fore and aft, and the 8-inch timbers up and down. Over these, again, will be the 4½-inch armour-plates, giving, with the interior plates, a solid thickness of iron and teak of between 23 and 24 inches. In this respect the *Achilles* will be constructed differently from the *Warrior* and *Black Prince*, both of which vessels have their armour-plates fixed amidships only, leaving the stem and stern entirely unprotected. In the *Achilles* every portion of the exterior of the vessel's side will be covered with armour-plates, which towards the stem and stern will not exceed 2½ inches in thickness, those portions of the vessel being the least exposed. To lessen the tendency to roll common to all our large iron ships of war, the *Achilles* is constructed flatter on the floors than either the *Black Prince* or the *Warrior*; her engines and machinery will also be placed about 2 feet lower, and nearer her kelson. It is intended to give the *Achilles* an additional mast, in order to render her more manageable when under canvas than the *Warrior*, which, it is now generally admitted, would have her sailing qualities improved by being provided with a fourth mast. Although the *Achilles* will be furnished with one more mast than her sister ships, the amount of canvas she will spread will scarcely exceed the *Warrior's*. The trim of the new frigate will be improved, and the sails being somewhat smaller than in our other large iron ships, the operations of reefing, shortening, and making sail will be attended with considerably less labour and difficulty. From the progress already made there is every probability of her being ready for floating out of dock by the end of next year. It will be 12 months later before she will be ready to proceed on her first cruise.

Double Screws: The Flora Steamship.—The trial of this vessel, which took place recently on the Thames, was attended with an unusual decree of interest, in a public and official sense, from the fact that the peculiar form of the vessel's construction and the disposition of her propelling steam power if successful on trial, combined the requisites required for our smaller ships of war, such as corvettes of the *Chanticleer* and *Rinaldo* class, and smaller craft as gunvessels of six guns and less, inasmuch as she was the representative of a class of ships capable of carrying a heavy armament of guns, with a large engine power, at a light draught of water, possessing at the same time a power of manœuvring in a small space such as could not, under any circumstances, be possessed by a vessel with the ordinary single screw. So important in fact, was the result of the *Flora's* trial considered by the Admiralty, that their inspector of machinery afloat, Mr John Dinnen, was present officially to report the result for the information of the Board. The *Flora* is an iron vessel of 400 tons, 160 feet in length, 22½ feet in breadth, and 15½ feet in depth, having two independent engines and screws with a collective nominal horse-power engine of 120 horses, the screws working under each quarter, and consequently before the rudder, in lieu of the present system of one screw astern and abaft the rudder. The diameter of the cylinders is 26 inches, with a stroke of 21 inches. Each screw has a diameter of 7 feet, with a pitch of 14½ feet. The boilers comprise two tubular, working at 30lb. pressure, and one high pressure working at 50lb. This high-pressure boiler is intended to be used for producing a steam blast in the chimney and to dry the steam (by admixture) from the two common boilers. The vessel is schooner-rigged, and without yards or any extra weight aloft, and, for her size, has a very handsome appearance on the water, giving promise of being a real clipper—a promise which her performances under steam during the day fully confirmed, for, if her tonnage and horse-power are fairly considered, there can be no doubt the *Flora* is the fastest screw steamship afloat. Her builders are Messrs. Dudgeon, of Millwall (both of hull and engines), and the success of the ship is a fitting tribute to an enterprising mercantile firm. The ship left Gravesend at noon, with a large party on board of officers and gentlemen interested in screw propulsion. There is nothing new in the idea of the use of two screws in the propulsion of ships, as our old floating iron-cased batteries are each fitted in the same way, but are worked by one motion from the engines. A small vessel in the *Clyde* works two screws also, with two rudders, the idea, as acknowledged by the adaptor, having been taken from the model exhibited in the Exhibition of 1851 by Mr A. Sturdee, the present master shipwright's assistant at Portsmouth dockyard. The *Flora*, however, is the first vessel that has been fitted with two screws and engines working separately and independently of each other; and herein lies the value of the principle in a military point of view, as giving a ship a means of rapidly revolving under steam and changing her position to any required point. The weather was fine, considering the season of the year; the atmosphere sufficiently clear to carry out the proposed experiments, with the wind at N. E., on leaving Gravesend somewhat light, but as the mouth of the river was reached freshing until it reached a force of between 4 × 5. The run from the Nore to the Mouse Light was made in 31 minutes 40 seconds, the tide being high water, slack on passing the Nore. This gave the ship a speed of 14·16 knots—an exceedingly favourable result. The ship's head was then brought round, and her course laid for the Nore, on reaching which preparations were made for making the important tests of the day—the capabilities of the ship in answering her helm and engines in making circles. The first experiment was made with both engines, going ahead at full speed, and the helm hard over, when the first circle was made in 3 min. 14 sec., the second in 3 min. 13 sec., and the third in 3 min, 16 sec, the diameter of the circles being about three lengths of the ship, and lessening each time. In the second experiment one engine and screw worked ahead, with the other going astern, and one circle was made in 3 min. 39 sec., and another in 3 min. 49 sec. In making these circles the action of the ship's hull was extraordinary, the central part being stationary, and both ends moving round equally; the circle was made on a pivot from the ship's midship section. The vessel was then put in a straight course, stopped, and from a state of rest the engines were started, one ahead and the other astern, the circle being completed in 3 min. 55 sec., and the diameter of the circle being, as before, within the ship's length. The vacuum throughout the trials was steady at 25 inches.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING DECEMBER 29, 1862.

(Compiled expressly for the Practical Mechanic's Journal.)

	1st week.			2nd week.			3d week.			4th week.		
IRON.	£	s.	n.	£	s.	n	£	s.	n.	£	s.	n.
Bars, &c., British, per ton,	6	10	0	6	10	0	6	15	0	7	10	0
Nail Rods,	7	0	0	7	0	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	5	0
Sheets,	9	0	0	9	0	0	9	0	0	9	10	0
Pig, No 1. Wales,	4	0	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	5	0	7	5	0	7	10	0	7	10	0
Rails,	5	7	6	5	10	0	5	0	0	5	0	0
Pig, No. 1. Clyde,	2	12	6	2	12	0	2	13	0	2	13	6
Swedish in bond,	10	5	0	11	10	0	11	0	0	11	0	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	0	0	15	0	0
In faggots,	16	10	0	16	10	0	16	10	0	16	10	0
SPELTER, ingot,	17	10	0	17	10	0	17	15	0	18	0	0
ZINC, sheet,	23	10	0	23	15	0	24	10	0	2	10	0
COPPER,												
Sheathing bolts, pr lb.,	0	0	11	0	0	10½	0	0	10½	0	0	10½
Bottoms,	0	0	10¾	0	0	11	0	0	11⅛	0	0	10⅝
Old,	0	0	9	0	0	9	0	0	9	0	0	8⅝
Tough Cake, per ton,	93	0	0	92	0	0	92	0	0	92	0	0
Tile,	98	19	0	98	0	0	98	0	0	98	0	0
TIN.												
English blocks, per ton, duty free,	111	0	0	111	0	0	112	0	0	112	0	0
Bars in barrels,	112	0	0	112	0	0	113	0	0	112	0	0
Refined,	116	0	0	116	0	0	117	0	0	116	0	0
Banca, in bond,	115	0	0	115	0	0	116	0	0	115	0	0
Straits, ditto,	114	0	0	113	0	0	113	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. 1C.	1	2	6	1	3	0	1	2	6	1	2	6
LEAD.												
English pig,	20	10	0	20	0	0	21	0	0	20	0	0
Sheet,	21	0	0	21	10	0	20	10	0	21	5	0
Spanish pig, in bond,	19	10	0	20	0	0	20	5	0	20	0	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	4	0	0	4	0	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	10	0
Deals, per C, 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	0	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	0	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gotbenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	48	0	0	48	0	0	48	10	0	48	0	0
" yellow,	43	0	0	45	0	0	45	0	0	45	0	0
Sperm,	82	0	0	83	0	0	82	0	0	82	0	0
Cod,	39	10	0	41	0	0	41	0	0	41	10	0
South Sea,	38	0	0	38	0	0	39	0	0	38	10	0
Olive, Gallipoli, per tun,	58	10	0	59	0	0	60	0	0	61	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	51	10	0	51	10	0	52	0	0	52	10	0
Rape pale foreign,	52	0	0	52	0	0	51	10	0	52	0	0
Linseed, per cwt.,	1	18	6	1	19	0	1	19	0	1	19	3
Rough Turpentine, per cwt.,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	15	0	4	0	0	4	0	0	4	0	0
Hemp Manilla,	34	0	0	33	0	0	34	0	0	35	0	0
Jute,	22	0	0	22	10	0	22	0	0	22	15	0
Hemp Rope,	24	0	0	24	10	0	25	0	0	25	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

5th November, 1862.

2994. R. A. Brooman, Fleet Street—Taps or cocks.—A com.
2995. R. A. Brooman, Fleet Street—Spinning frames.—A com.
2996. Clifton Shield, Newcastle-upon-Tyne—Malleable cast iron.
2997. A. V. Newton, Chancery Lane—Obtaining printing surfaces, dies.—A com.
2998. John Petrie, Rochdale, and James Teal, Sowerby—Washing wool and other fibrous materials.
2999. Samuel Tragheim, Leith—Treating hemp.
3000 Daniel Hill, Camden Road—Stamping and counting bank notes.
3001. J. J. Laveissiere, Paris—Metal tubes.
3002. Thomas Brown, Wood Street—Surfacing fibrous materials.—A com.

6th November, 1862.

3003. Frederick Goodyear, Old Change—Plaiting straw, &c.—A com.
3004. W. E. Gedge, Wellington Street—Lift and force pump.—A com.
3005 B. T. U. Monin, Paris—Breech-loading fire arms.
3006. Henry Griffin, Silvertown—Securing india rubber cylinders or rollers and blocks upon spindles.
3007. W. N. Hutchinson, Plymouth—Protecting the screw of steamers.
3008. J. A. Fullarton, Manchester—Painting or coating articles of metal, &c.

7th November, 1862.

3009. M. A. F. Mennons, Paris—Paper.—A com.
3010 C. O. Heyl, Berlin—Extracting and purifying oils.
3011. William Clark, Chancery Lane—Utilizing refuse and azoted matters of commerce.—A com.
3012. A. V. Newton, Chancery Lane—Repeating fire-arms.—A com.
3013. Thomas Greenwood and James Schofield, Rochdale—Spinning mules.
3014. J. H. Johnson, London and Glasgow—Decorticating grains.—A com.

8th November, 1862.

3015. Henry Gardner, Leeds—Treating fibrous materials.
3016. Henry Kilshaw, Haslingden, and Edward Lord, Rawtenstall—Power looms.
3017. G. H. Ogston, Mincing Lane—Nitric acid.
3018. C. W. Spruyt, New Broad Street—Rails for railways.
3019. William Simpson, Liverpool—Letter boxes.
3020. G. L. Locke, Hampstead New Road, and James Clark, High Street—Motive mechanism of pianofortes.
3021. Edward Sonstadt, Nottingham—Metal magnesium.
3022. George Kent, High Holborn, and E. P. Griffiths, High Street—Reducing cocoa berries and mashing potatoes.
3023. J. and T. Mellodew, Oldham, and C. W. Kesselmeyer, Manchester—Looms for weaving.

10th November, 1862.

3024. G. H. Sanborn, Cheapside—Wringing machine.
3025. Charles Connell, Glasgow—Ships or vessels.
3026. John Whitaker, Leigh—Stripping and slicing roots.
3027. J. B. Lavoine, St. Pierre, France—A kitchen range.
3028. Samuel Berrisford and William Ainsworth, Stockport—Looms.
3029. R. R. Holmes, British Museum—Folding chairs and seats.
3030. R. J. Chapman, South Street—Glass and emery paper or cloth.
3031. James Shanks, Arbroath—Mowing machines.
3032. W. E. Newton, Chancery Lane—Maize or Indian corn.—A com.
3033. James Easton and J. C. Amos, Grove, Southwark—Sawing wood.
3034. T. G. Ghislin, Hatton Garden—Foreign Plant fibres.
3035. G. F. Lyster, Liverpool—Elevating grain and other granular substances.

11th November, 1862.

3036. George Davies, Serle Street—Crinoline skirts.—A com.
3037. W., J. and T. Booth, Oldham—Rotary engines.
3038. William Palliser, Dublin—Ordnance and projectiles.
3039. Henry Burridge, Grenville Street—Fire-proof buildings
3040. J. J. Parkes, London Street—Lever bell pulls
3041. Edward Marriott and Samuel Holroyd, Manchester—Purification of gas.

12th November, 1862.

3042. William Harper, Sharples, Lancaster—Furnaces.
3043. W. & J. Galloway, Manchester—Cutting, punching, and compressing metals.
3044. George Smith, Cobden Street—Obtaining colouring matter.
3045. William Dobson, Nottingham—Dressing lace or other fabrics.
3046. Christoph Socin, Holborn—Looms for weaving ribbons
3047. Thomas Bradford, Manchester—Wringing and mangling machine.
3048. F. J. Clowes, Southwark Bridge Road—Rotary motion
3049. Joseph Faulding, Euston Road—Locomotive engines.
3050. J. H. Thomson, Glenboig, Lanark—Finishing and dressing tiles.
3051. J. A. Duntze, Woolwich Common—Communicating rotary motion.—A com.
3052. Aloise Graemiger, Wallenstadt, Switzerland—Looms.

13th November, 1862

3053. Alexander Twaddell, Glasgow—Dressing or sizing warps.
3054. G. W. Rendel, Newcastle-on-Tyne—Hardening cannon.
3055. G. W. Rendel, Newcastle-on-Tyne—Armour plates.
3056. T. C. and J. Eastwood, Bradford—Combing wool.
3057. James Stack, Manchester—Nursery swings.
3058. Moss Defries, Houndsditch—Construction of lamps
3059. W. E. Gedge, Wellington Street—Air engine.—A com.
3060. R. and P. Sykes, Huddersfield—Machines for spinning and doubling.
3061. E. S. Ritchie, Brookline, Massachusetts, U.S.—Mariner's compass.
3062. George Davies, Serle Street—Preserving provisions.—A com.
3063. R. A. Brooman, Fleet Street—Apparatus for shunting trains.—A com.
3064. Emanuel Joseph, Blackfriar's Road, and Joshua Danks, Webber Row—Brushes, brooms and mats.
3065. C. G. Kopisch, Bishopsgate Street—Propelling and ventilating vessels.

14th November, 1862.

3066. E. S. Cathels, Shrewsbury, Shropshire—Manufacture of gas.
3067. E. B Wilson, Parliament Street—Conveying air, steam, gases, and fluids to oscillating or vibrating cylinders and vessels.

3068. W. H. Andrew, Sheffield—Scissors and shears.
3069. Samuel Roberts, Sheffield—Frames for bottles and jars.
3070. Hugh Morgan and John Parkinson, Liverpool—Weighing machines.
3071. V. S. Cassaignes, Gavundun, France—Stereoscopes.

15th November, 1862.

3072. Christopher Binks, Parliament Street—Treating oils and fats.
3073. J. S. Clegg and James Slater, Oldham—Carding engines.
3074. Louis Croc, Aubusson, France—Ink for telegraphic printing.
3075. Edward Kirby, Birmingham—Pulley for window blinds.
3076. John Rimmer, Liverpool—Hansom cabs
3077. A. and H. Illingworth, Bradford, York—Washing wool.
3078. George Sugden, Jonas Briggs, and John Lockwood, Bradford—Spinning.
3079. E. H. Duru, Poitiers, France—Motive power engine.
3080. H. B. Whitburn, Orrell Colliery, Lancaster—Manufacture of glass.
3081. W. H. James, Old Kent Road—Steam engines.
3082. James Wilson, Royal Exchange Buildings—Hydraulic pumps.—A com.
3083. George Gray, Greenwich—Wheels.
3084. Fitzmaurice Palmer, Northumberland Street—Projectiles.

17th November, 1862.

3085. Christopher Binks, Parliament Street—Oxygen and chlorine gases.
3086. Ferdinand Rables, Albert Street—Envelopes.
3087. William Dobson, Nottingham—Lace dressing frames.
3088. David Thomson, Grosvenor Road—Screw cocks.
3089. Wellburu Williamson, High Holborn—Washing and mangling machines.
3090. Charles Littleboy, Straffau, Kildare—Cultivating land.
3091. George Richards, Caroline Street—Ordnance fire-arms and projectiles.

18th November, 1862.

3092. James Raphael, City Road—Umbrella and walking sticks.
3093. Jacques Arbos, Barcelona, Spain—Generating gases.
3094. P. H Klein, Paris—Turning or shaping metals.
3095. W. H. Burnett, Margaret Street—Telegraphic apparatus.
3096. E. P. Houghton, Liverpool—Breaks.
3097. C. W. Harrison, Lorimer Road—Looms for weaving.
3098. Charles Neild, Cheadle, Chester, and John Hopkinson, Manchester—Fire alarums and indicators of temperature.
3099. Robert Brown, Birmingham—Warming and ventilating.
3100. Nathan Thomson, Abbey Gardens—Stopping bottles and jars.
3101. Richard Beck, Upper Holloway—Reading glasses and magnifiers.
3102. James Oxley, Frome—Separating liquid from substances.

19th November, 1862.

3103. Louis Lenzberg, Oxford Street—Raising and lowering blinds.
3104. H. J. F. Marmet, South Street, Finsbury—Lamps.
3105. James Chalmers, Knight's Place—Armour for vessels and fortifications.
3106. Robert Mushet, Coleford—Cast steel
3107. S. S. Brown, Runcorn, Chester—Elastic fabrics or garments.
3108. Jacques Arbos, Barcelona, Spain—Generating gases
3109. R. A. Brooman, Fleet Street—Boilers, condensers, and superheaters.—A com.
3110. Caleb Kilner, Islington, and G., W., and S. Kilner, Thornhill Lees, near Dewsbury—Manufacture of glass.
3111. J. B. Edmondson and James Carson, Manchester, and John Blaylock, Carlisle—Printing, numbering, and dating railway and other tickets.
3112 Robert Hardman, Bolton-le-Moors—Looms for weaving.
3113. G. A. Buchholz, Montague Place—Semoliua and flour.

20th November, 1862.

3114. J. T. Hutchings, Charlton—Waterproof boot and shoe soles.
3115. Joseph Jewsbury, Kniver, Stafford—Machines for raising weights,
3116. Charles Stevens, Charing Cross—Brick-making machine.—A com.
3117. G W. Oldham, Honley, near Huddersfield—Dyeing.
3118. Fielding Fletcher, Birmingham—Force pumps.
3119. R. A. Brooman, Fleet Street—Recording the course of ships.—A com.
3120. J. W. Child, Halifax—Wool and other fibres.
3121. Frederic Seiler, Paris—Motive power engines.
3122. R. B. Seeley, Mortlake—Inkstands
3123. J. W. Hjerpe, Wilhelm Holmgren, and A. V. Sunstedt, Stockholm, Sweden—Composition for igniting matches.
3124. William Bottomley, Bramley, Leeds—Stiffening fabrics.

21st November, 1862.

3125. William Sinnock, Nicholas Lane—Treatment of fibrous materials.
3126. Charles Hadfield and W. Attkins, Hadfield—Bricks and tiles.
3127. Joseph Townsend, Glasgow—Preserving vegetable substances and fabrics.
3128. J. R. Napier and W. J. M. Rankine, Glasgow—Boilers and valvular mechanism.
3129. W. E. Gedge, Wellington Street—Elastic fastening glove.—A com.
3130. Dan Saul and Moses Morris, Swinton—Crinoline skirts
3131. James Steart, St James's Road—Fibre from zostera marina.
3132. Thomas Walker, Birmingham—Utilizing sewage matters.
3133. Charles Wagner, Liverpool—Soles of boots and shoes,—A com.
3134. R. W. Swinburne, South Shields—Manufacture of soda.
3135. G. G. Sanderson, Rotherham—Armour for fortifications, &c.
3136. John Taylor, Streatham—Tiles for building purposes.
3137. C. A. Orth, Church Road—Motive power.
3138. Solomon Deacon, Alma Street, and Charles Deacon, Rushton Street—Tops, caps, and windguards for chimneys.
3139. Aaron Sutton, Paris—Time indicator for public vehicles.

22d November, 1862.

3140. W. E. Gedge, Wellington Street—Elliptical compass.—A com.
3141. W. E. Nethersole and Charles Buckland, Swansea—Safety signals for fire-arm practice.
3142 Michael Mishores, Newcastle Street—Handles for umbrella sticks, &c.
3143. Charles de Bergue, Manchester—Metal reeds for weaving,
3144. Charles Powell, Birmingham—Watches and time keepers.
3145 William Clark, Chancery Lane—Candle lamps.—A com.
3146. A. V. Newton, Chancery Lane—Cutting corks.——A com.
3147. James Webster, Birmingham—Burners and blow pipes.

24th November, 1862.

3148. T J. Searle, Darnley Road—Raising and forcing fluids.
3149. J. B. Howell, Sheffield—Armour plates, and shot and shell.
3150. William Clark, Chancery Lane—Obtaining a vacuum in the manufacture of paper.—A com.
3151. R and W. Hawthorn, Newcastle-on-Tyne—Pump valves.
3152. John Barclay, Kilmarnock—Rollers for printing textile fabrics, and in apparatus for drying and finishing fabrics.
3153. J. H. Johnson, London and Glasgow—Burnishing metal surfaces.—A com.
3154. Evan Leigh, Manchester—Cotton gins.
3155. William Tatham, Rochdale—Preparing and spinning fibrous materials.
3156. N. J. Amies, Manchester—A substitute for elastic woven webs.

25th November, 1862.

3157. John Moule, Seabright Place—Deodorizing mineral oils.
3158. T. and L Robertshaw, Bradford—Manufacture of moreens.
3159. A. L. Woolf, Birmingham—Metallic alloy.
3160. Edward Wadsworth, Macclesfield—Manufacture of braid
3161. J. S. Jarvis, Wood Street, and J. H. Brierley, Aldermanbury—Ladies and gentlemen's leather collars.
3162. W. B. Caulfield, Queen Street—Porous stems for tobacco pipes.
3163. George Henderson, Mincing Lane—Steam engines.—A com.
3164. George Ranson, Eccleston—Preparing clay for brick making.
3165. A. V. Newton, Chancery Lane—Sewing machines.—A com.
3166. William Longley, Leeds—Making bricks.
3167. T. M. Elton, Golden Lane—Soap.

26th November, 1862.

3168. Thomas Fletcher, Rochdale—Rollers, cans, spools, and bobbins.
3169. James Aspell and Edward Booth, Middleton—Looms for weaving.
3170. Joseph Stienthal, Gorton—Moulder's blacking.
3171. Francis Palling, Esher Street—Fountain penholder.
3172. J. F. Foveaux, Strand—Dividing liquids into spray.—A com.
3173. William Austin, Furuival's Inn Place—Cartridge cases.
3174. J. R. Danks, B. P. and R. P. Walker, Wolverhamptou—Boot and shoe heel and toe tips, clog irons, &c.
3175. A. V. Newton, Chancery Lane—Oxide of zinc as a pigment—A com.

27th November 1862.

3176. John Halford, Great Barr—Casting and moulding metals
3177. A. A. Phéloux and P. A. Paumier, Paris—Atmospheric sailing propeller.
3178. F. W. Hartley, Millbank Street—Products from coal gas—A com.
3179 Thomas Keyworth, Boston, Lincolnshire—Motive power machinery.
3180. W. T. Rowlett, Leicester—Knit or looped fabrics
3181. D. and D. Auld, jun., Glasgow—Working furnaces and boilers.
3182 J. L. Linton, New Jersey, U.S.—Generating steam,—A com.
3183. Dirk Veerkamp and C. F. A. V. Trigt, Mercers Terrace—Treatment of old manufactured fabrics to obtain useful fibrous products therefrom.
3184. William Clark, Chaucery Lane—Preservation of animal and vegetable substances.—A com.
3185. William Clark, Chancery Lane—Gas burners.—A com.

28th November, 1862.

3186 Joseph Carbonell, Paris—Preparing paper pulp from plants.
3187. W. A. Waddington, York—Cutting wood.
3188. J. T. Caird, Greenock—Steam engines.
3189. J. H. Johnson, London and Glasgow—Indicating the pressure of electric conductors in foreign bodies.—A com.
3190. Franz Boecke, Berlin, Prussia—Sewing or uniting fabrics.
3191. J. Cresswell and E. T. Greves, Birmingham—Hearses and funeral carriages
3192. S J Browning, Portsmouth—Machines to be employed in brewing.
3193. William Clark, Chancery Lane—Permanent way.—A com.
3194. Wentworth Buller and Jabez H. Mugford, Bovey Tracy, Devon—Spur supporting rings for fixing plates in glost ovens.
3195. J. F Delany and J. C. R. Okes, Greenwich—Steam engines.
3196. James Adams, Bridgehouse, Bow, and W. C White, King Street—Boiling and evaporating.
3197. Alexander Dudgeon, Cullum Street—Packing for steam engines.

29th November, 1862.

3198. W. E. Gedge, Wellington Street—Clocks or timekeepers.—A com.
3199. Thomas Blackburn and Mark Knowles, Blackburn—Looms for weaving.
3200. F. G. Taylor, Manchester—Washing machines.
3201. James Crompton, Bolton—Ploughing and drilling land.
3202. Thomas Lloyd, Liverpool—Wheels of vehicles.
3203. Thomas Evans, Abergavenny—Antigrophilos.
3204. William Clark, Chancery Lane—Cutting corks—A com
3205. Francis Vacher, Parliament Street—Ornamenting playing cards.
3206 J. C. Robertson, Gracechurch Street, and W. C. White, King Street—An improved tap or cock.
3207. Rev Henry Moule, Fordington—Locomotive engines and generating steam.
3208. Daniel Sutton, Banbury—Washing linen.
3209. John Anderson, C.E., Royal Arsenal, Woolwich—Tyres of railway wheels, and rails, switches, and crossings of railways.
3210. R K Penson, Ferryside—Warming railway carriages.—A com.
3211. Michael Henry, Fleet Street—Manufacture of leather.—A com.

1st December, 1862.

3212. H. L Emery, Albany, U.S.—Thrashing machines.
3213. Peter Bourne, Whitehaven—Miners' lamps.
3214. G. F. Griffin, New Adelphi Chambers—Permanent way.
3215. Thomas Waller, Fish Street Hill—Stoves.
3216. John Irwin, Wellingborough—Cultivating land.
3217. Robert Flude, Leicester—Looms for weaving narrow fabrics.
3218. John Coppard, Hoxton—Roughing horse shoes.
3219. Joseph Romer, Shipbourne—Bullion wire.
3220. William Clark, Chancery Lane—Water meter, hydraulic metor, or a steam engine.—A com.

2d December, 1862.

3221. P. W. Renter, Buckland Crescent—Compound for dyeing and printing.—A com.
3222. E D. Johnson, Wilmington Square—Pocket watches.
3223. Benjamin Oldfield, Coventry—Looms.
3224. A. V. Newton, Chancery Lane—Steam and other vessels.—A com.
3225. Harper Twelvetrees, Bromley—Cleaning knives, forks, and boots.
3226. Harper Twelvetrees, Bromley—Sawing and turning apparatus.
3227. Harper Twelvetrees, Bromley—Washing and mangling machines.
3228. Pauline Brassert, St. Anne's Road—Apparatus for saving life and property in cases of fire or burglary.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 18th November to 4th December, 1862.

Nov.	18,	4525	Blumberg and Co., Carman Street West, E.C.—"A Paté Holder."
,,	,,	4526	William Reaney, Sheffield—"Improved Shoe Sole Cutter."
,,	27,	4527	Hodge and Reed, Hatton Garden, E.C.—"Lantern."
Dec.	1,	4528	Smith and Wellstood, Glasgow—"Columbian Steam Cooking Table."
,,	4,	4529	W. Burroughes and F. Watts, Soho Square, W.—"A Billiard Marker."

RI

BULLET MAK

DESIGNED BY JOHN

WOOLWIC

Fig. 1.

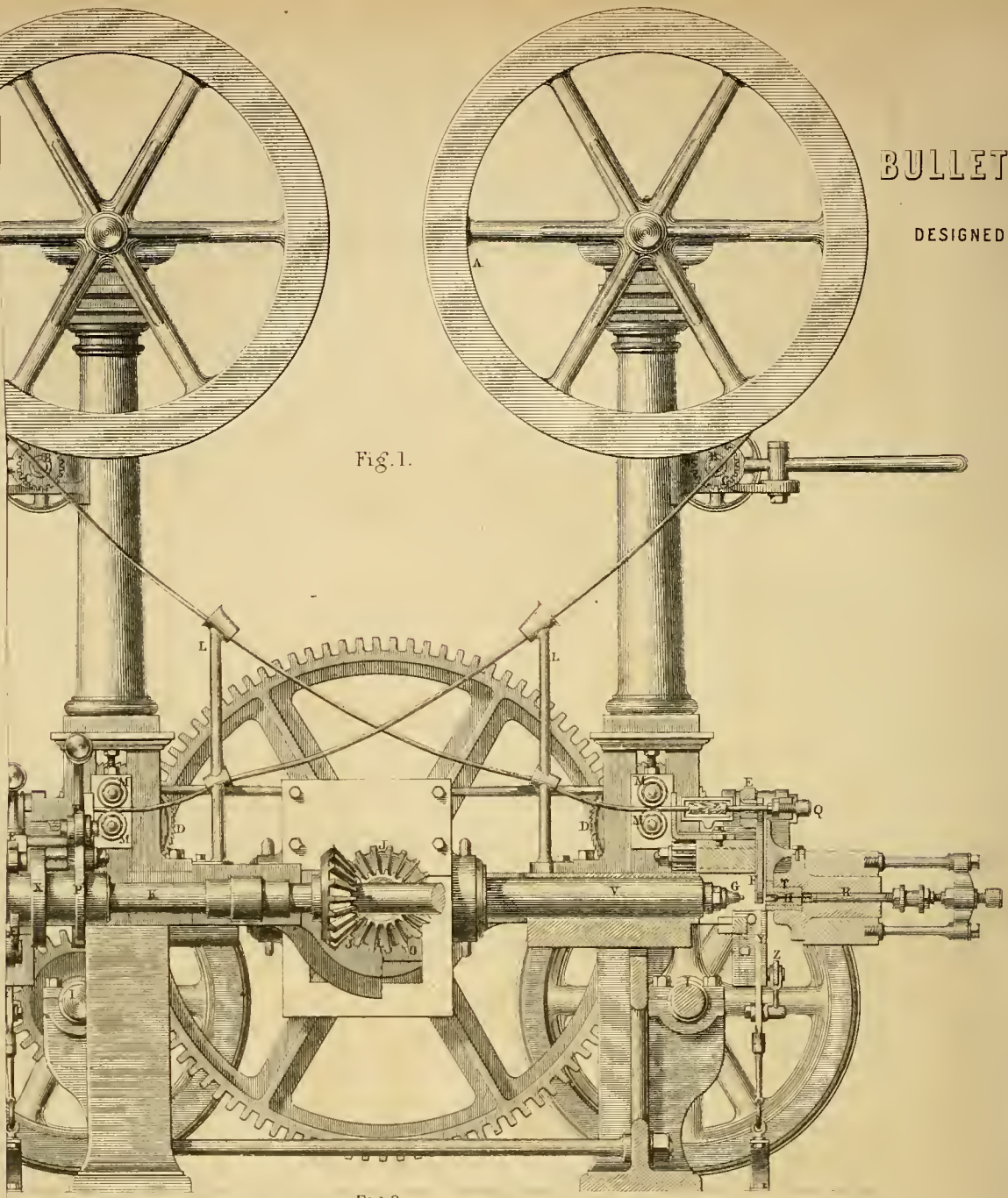
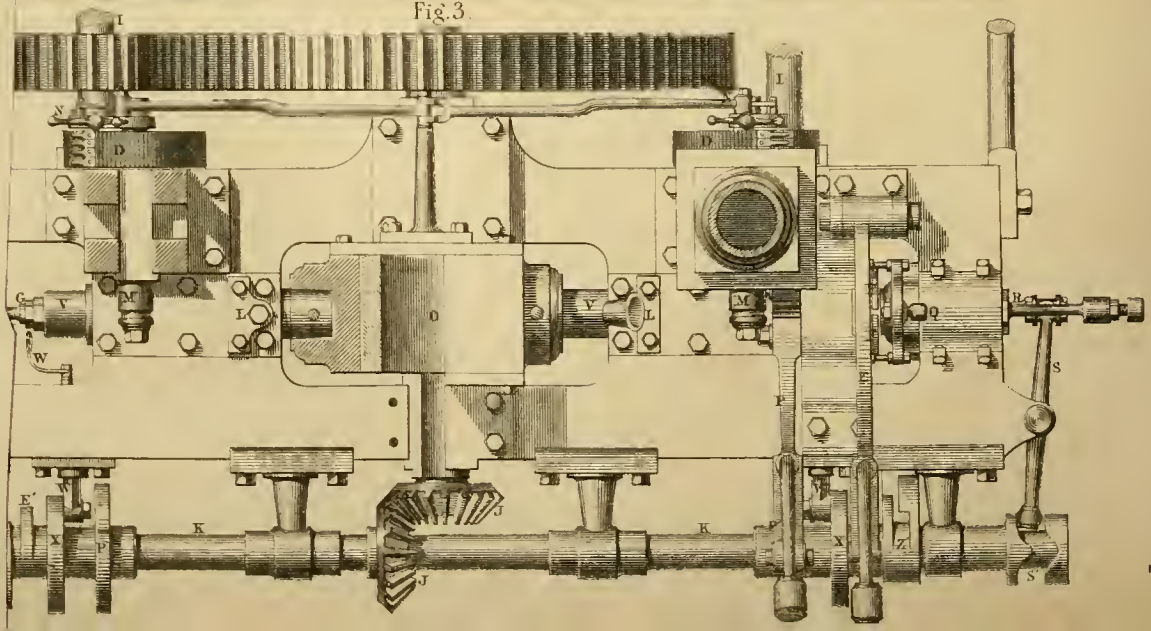


Fig. 3.



MACHINE,

SON ESQR C.E.

SENAL.

Fig. 2.

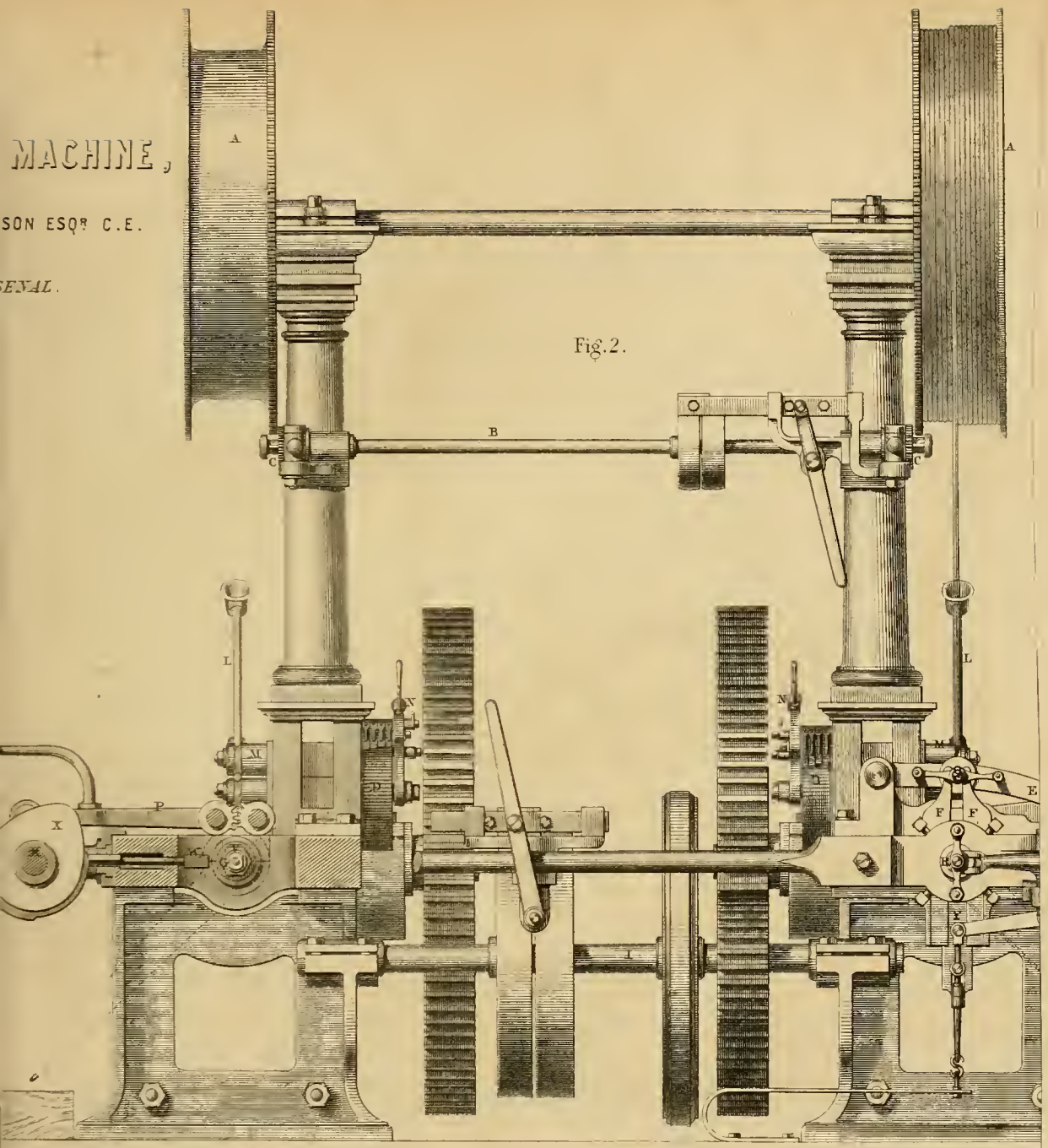


Fig. 4.

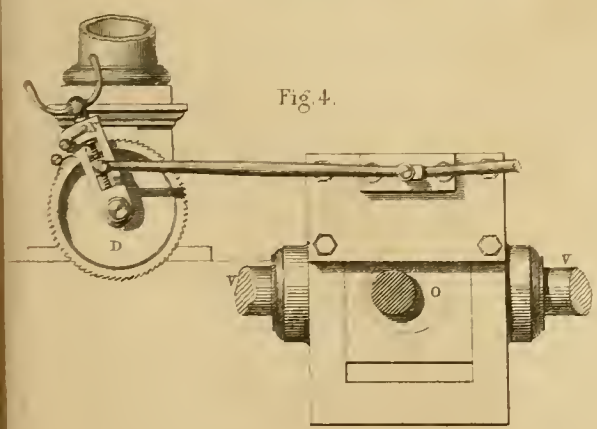
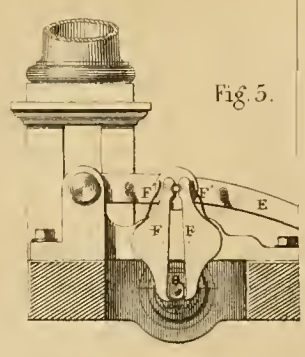


Fig. 5.



—SCALE.—

1 2 3 4 5 6 7 8 9

RIFLE BULLET MAKING MACHINE,

DESIGNED BY JOHN ANDERSON ESQR C.E.

WOOLWICH ARSENAL.

Fig. 1.

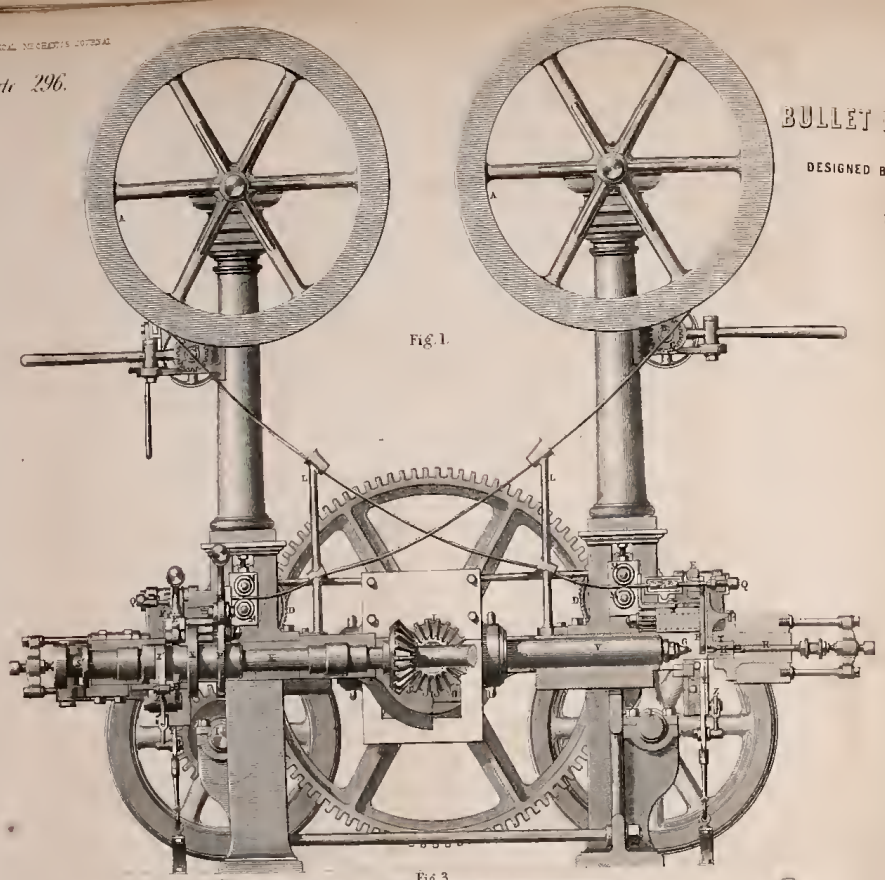


Fig. 2.

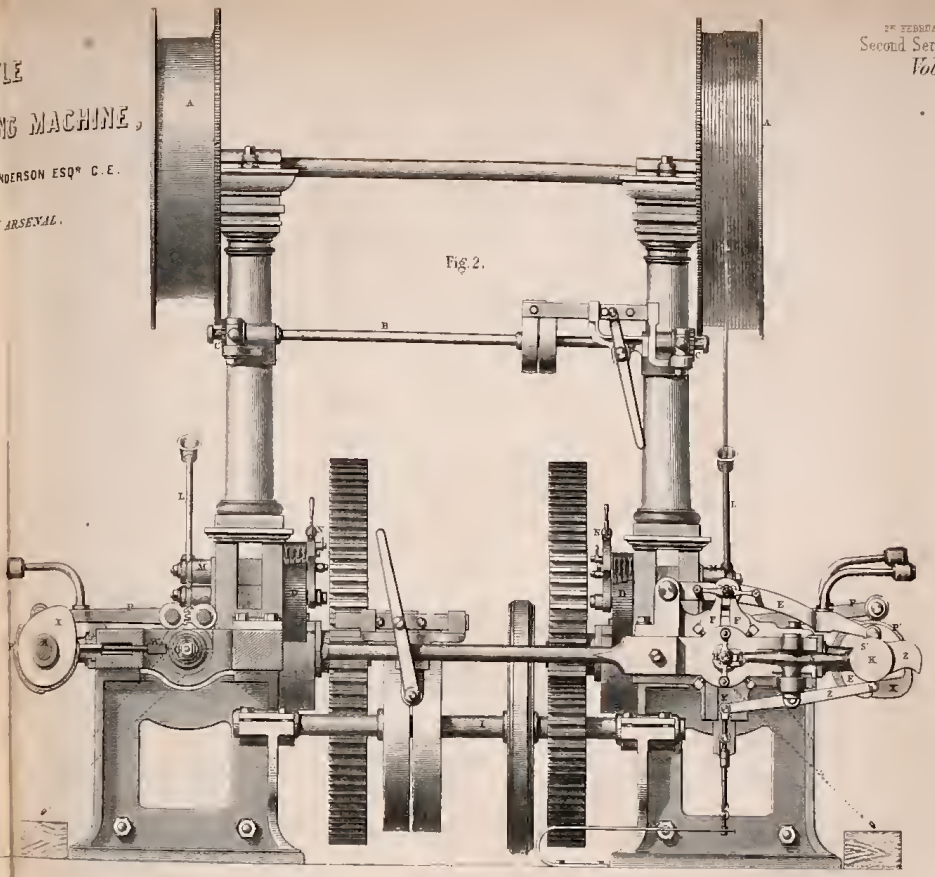


Fig. 3.

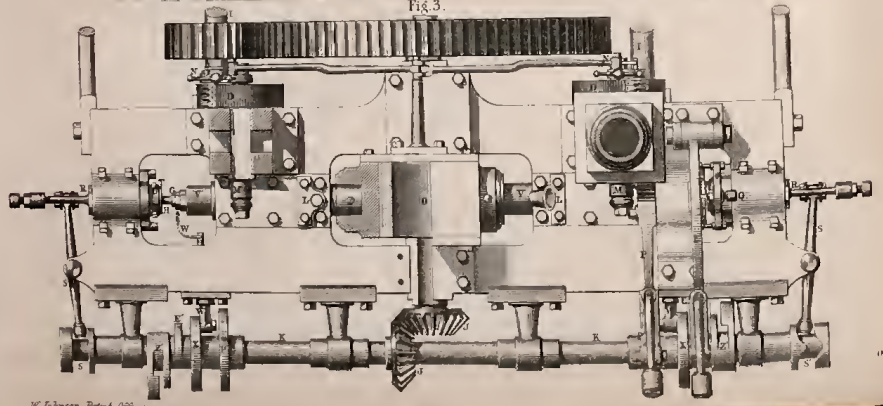


Fig. 4.

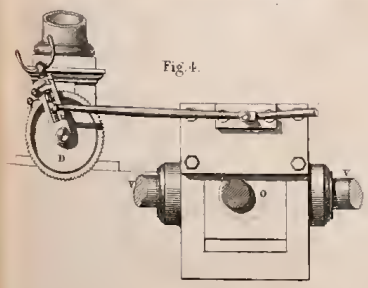
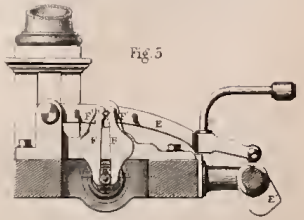
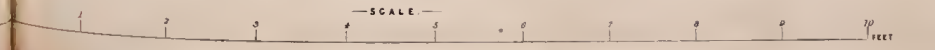


Fig. 5





RIFLE BULLET MAKING MACHINERY—WOOLWICH ARSENAL.

Illustrated by Plate 296.

Amongst that enormous collection of machinery devoted to the formation of instruments of destruction, the complex product of many minds, that is spread over acres of ground, stretching for more than two miles along the bank of the Thames, at Woolwich, there are few more interesting, than those by which the modern rifle bullet is produced.

Precision in the projectile was the inevitable consequent upon precision in the weapon. With the old, smooth bore and spherical ball, and the moderate range at which it was effective, or the still more restricted one at which aim was possible, irregularity of form in the bullet, want of homogeneity in its mass by hollows or "draws" due to its contraction in cooling and chilling exteriorly first, or even a difference of some grains in weight between one ball and another, were not very important. Nor would more perfect balls have done much to improve the weapon, while the windage was so great, and while the soldier "bit his cartridge," and spilled more or less of the powder, that was supposed to give a projectile power as constant, as the resistance due, to a bullet of always equal weight. The old method of making, in our arsenals, the balls that won battles from before Malplaquet to Waterloo, differed in nothing except in the scale upon which it was carried on, from the rude process and tools by which the old highwayman or the Ribbaudman cast their bullets. The miscalled balls were simply cast, from ladles of liquid lead, into long brass moulds, opening with hinges at one end.

These moulds had their concavities grubbed out, by spherical rose cutter tools, upon which, as they revolved in a lathe, the jaws of the mould were closed, the neck of the tool forming the gait for the entrance to the lead. From a variety of causes, all small though efficient, but mainly from the warping and bending of these long brass moulds themselves, by unequal expansion in being heated by the lead, and now and then cooled with water, &c., the bullets cast in them were never exactly spherical. The necklaces of balls, as they were taken out of the opened mould, were heaped up together, and the soft, warm lead was dinged by one piece striking another. They then were passed on to boys, who were provided with nippers that cut off the necks or gaits, and the separated balls were finished by trundling them together for some hours in barrels, with a certain portion of powdered black lead. The nippers, for a long time, were only common cutting pliers like sharp-edged carpenter's pincers, and so that part of the bullet where the neck was cut off, was never part of the surface of a sphere at all, it was always flat, and sometimes in excess, sometimes deficient, of the full volume of the globe.

The next improvement, we believe brought from France, consisted in supplanting these nippers, by a very elegant little hand tool, which swept off the lead of the neck, by a cut that was truly a portion of the sphere.

Some years elapsed, during which bullets still continued to be cast, when the first machine for producing them by compression was devised and constructed (if we mistake not) by Mr David Napier, then of Glasgow.

This machine operated upon cylindrical rods or sticks of lead, which were rolled to the diameter of the intended bullet, between grooved rollers, from thicker pieces cast in metallic moulds. These rods, held by hand, were pushed in through the blades of a pair of shears, whose opposite edges were sunk into semi-circular cavities, and against a stop; and thus the rods were chopped up into short cylinders, the diameter of which was equal to that of the intended ball, and whose length was such, that if any one piece were squeezed between two hemispherical dies of its own diameter, the lead should just fill them in becoming a sphere, *i.e.*, the length of each cylinder was, *quam prox*, two-thirds of its diameter. This machine effected an enormous improvement upon the old method of production, in perfection of form, in absolute solidity of substance, and in rate of production; but it was neither complete enough nor fast enough, for the requirements of a later period. We believe, however, that some of these very machines were altered, and for some time employed, to produce the first forms of Minie bullets; and a machine of this sort was exhibited, in class 7, No. 1669, at the late Exhibition, by its manufacturers, Messrs D. Napier & Sons, of Lambeth.

Bullet-making machines by pressure were produced in America also, several years since, by Mr Adair, and we believe are those employed in the United States Arsenals.

There is much in common, of course, in all machines destined for a common object. We understand that the bullet pressing machines, now, and for some years, in use at Woolwich, are mainly, if not entirely, due to the design of Mr John Anderson, C.E., now Superintendent of the Royal Gun Factories, while, as yet, he was General Superintendent of machinery in the Arsenal. Plate 296 shows, in detail, the construction of one of these truly elegant machines, the action of which we are about to describe. It will be in the recollection of our readers, that the War Department exhibited large sized drawings, by Mr Anderson, of the whole train of bullet machinery under the class of military engineering, at South Kensington last year. The train of operations, by which the pig of lead, is at last converted into the finished bullet, may be divided into two great stages, viz., that by which the crude metal is reduced to the form of a long round rod or continuous bar of lead, equal in diameter, to the proposed bullet; and that by which these lead rods are fashioned into the projectiles. The first part, in the older apparatus was, as we have seen, done by rolling between grooved rollers. This had many objections. There was a thin fin or film, often left along opposite sides of the rod, by the rollers not perfectly meeting; there was waste, both of power and material, and the process was slow, too slow for days of wholesale slaughter. We know not how far the substitution for this of the existing beautiful process of "squirting," or pressing out the lead in a continuous rod, from a large cylindrical block, is attributable to Mr Anderson as its author, though, no doubt, the machinery for performing it first, has been perfected under his care and eye.

The principle itself, as applied to a perfectly analogous end, namely, the production of a continuous *hollow* cylindrical rod, *i.e.*, a lead pipe, is by no means new. It was first proposed, so far as our knowledge goes, by Mr Joseph Bramah, the inventor of the hydraulic press, for the purpose of producing lead pipes in continuous length; and though the plan does not appear to have been ever even tried by him, we are ourselves personally cognizant, of apparatus having been actually constructed in Ireland for the same end and on the same plan, and independently devised by Mr John Mallet about the years 1808 or 1810. However, the present application to the production of bullet rods was not the less happy and advantageous; for besides the perfection of form and absolute soundness of material in the lead ejected from the steel conical die, the saving of loss by oxidation and economy of power are very great. Lead when at 300° to 500° of Fahr., approaches much more nearly to the state of a very thick fluid, than even when cold; for in truth fluidity and solidity in all material substances, pass by insensible degrees into each other; and at this higher temperature, it is amazing how readily the whole cylindrical block of lead, confined within its iron girth, and with no escape except through the small "squirting" hole of the die on top, when pressed by the ram from beneath, urged on by the heavy pressure from probably as large a diameter of hydraulic press as has ever been made, obeys the laws of fluids, and shows that, *quaquaverse* pressure is propagated through all its molecules, just as though it were plastic clay, or butter, or oil, or water.

Except the method by which, under very like conditions, Rand's patent collapsible tubes (in which paints and perfumes, &c., are now made up and sold) are struck up from metallic tin or its alloys, we know of no more beautiful illustration of these physical properties of the more ductile metals, than may be seen in the bullet rooms at Woolwich.

But we must hasten to describe the machine and its action.

The projectile employed for the Enfield rifle is of a semi-elipsoidal form, and has its flat end hollowed out for the purpose of allowing the metal to expand into the grooves of the barrel by the force of the explosion.

The manufacture embraces the following requirements, viz., that the bullets must be made of the most accurate dimensions and weight, their density must be perfectly uniform, in order to secure the greatest precision in firing, and the lead must be of the necessary softness to afford the required expansion into the rifle grooves, without which rifling is useless. When the Minie rifles were first introduced, their bullets were first cast in a mould, and then finished with dies in an ordinary fly press.

The first improvement in the above method consisted in casting the lead into rods of the required diameter, and then, by means of hand shears, cutting the rods into small cylindrical pieces of the required weight—a fly press and pair of dies being employed to convert these into bullets. This, however, in practice, proved a failure as to accuracy of production, because the weight of the bullets depended wholly on the amount of lead cut off, and could not be strictly insured by this primitive method of cutting. The machine for manufacturing the Enfield rifle bullet is shown in Plate No. 296. Fig. 1 is a front view of the machine, half in elevation, and half in section. Fig. 2 shows a side view of the machine, half in elevation, and half in section. Fig. 3 is a plan partly in horizontal section, showing the general arrangements. Fig 4 is a detailed side view of the feeding mechanism; and fig. 5, a side view of the cutting lever and nippers. The lead is brought to the machine in the form of a continuous cylindrical rod, coiled upon reels.

This lead rod is rather smaller than the diameter of the finished bullet, and is produced by the operation above referred to, as "squirting." The lead having been melted in a cast iron pot, heated by a fixed furnace, is run thence into a cylindrical mass of some inches in diameter and about two feet in length, by passing it into a cast iron mould of great strength and thickness, placed vertically above an hydraulic press cylinder also fixed vertically. The mould is large enough to contain the proper quantity of lead to form one full coil of lead rod.

The lead is not permitted to get quite cold, but when in a warm and still soft and plastic state, is forced, by the pressure of the hydraulic cylinder, the plunger of which rises beneath, ejecting the lead from its mould, through a die with a hole of the required diameter, which die is fixed above the mould. From this die the lead is thus "squirted" out in the form of a thin rod, and at the same rate that it is ejected, it is coiled upon reels, each containing about 5 cwt., which revolve slowly above the apparatus.

The reels are then carried to the bullet machine, and the rod is wound off them, to the reels on the machine, by means of the small shaft, B, and pinions, C, working into the peripheries of the reels, A, and driven by power as shewn.

By the plan. fig. 3, it will be perceived that the bullet compressing machine consists of four separate sets of dies, each of which is complete in itself, and consists of a reel, A; a self-acting motion, D, for feeding the lead wire from the reel to the dies; a shearing lever, E; a pair of grippers, F; a punch, G; and a die, H. Each such set of die apparatus, is an exact duplicate of the others. The various motions are obtained from the two driving shafts, I, each shaft respectively working the eccentric shafts, O, and those again, by means of mitre wheels, J, give motion to the shafts, K, the cams of which are adjusted so as to accurately perform their various duties.

The successive operations of the machine in forming a bullet consist of, cutting off the lead from the end of the lead rod wound off the reels, and delivering it into the dies, forming and hollowing the rear end of the bullet, cutting off the film of superfluous lead from the bullet, and ejecting it from the die. The lead rod being coiled upon the reel, A, is passed through the guides, L, to the feeding rollers, M.

These rollers are worked by a ratchet wheel and pawls, D, at the base of each of the columns supporting the reels, which receives its motion from the reciprocating movement of the eccentric, by which the compression is produced. The guide rollers, M, are grooved so as to grip the lead rod sufficiently to unwind it from the reel, A, and are adjustable for taking greater or less grip as may be required, but without reducing or marking the lead. The amount of feed is determined by the adjustment of the pawl stud on the rocking lever, N, and this is regulated to cut off the exact amount of lead required to form each bullet. The end of the lead rod is then fed through the equal sized cylindrical hole in the shearing lever, E, which is bushed with steel so as to form a sharp cutting edge.

As soon as the lead is pushed through the lever, E, to the requisite distance, its free extremity is seized by the grippers, F, and the lever, E, is immediately raised by its cam, E^1, leaving the piece of lead in the firm clutch of the grippers; and the moment that the shearing lever, E, has cleared the lead, the grippers open sufficiently to allow the short cylinder of lead to drop to the lower end of these. The grippers then almost instantly afterwards, close in time to catch the lead cylinder, and hold it in an horizontal position, and with its end immediately in front of the die. To prevent any possibility of the lead piece not dropping from top to bottom of the grippers, two springs, F^2, are employed, which act on it at the same moment that the grippers open. At this momentary position of the machine, the punch, O, propelled by the eccentric, O, presses the lead piece into the die, H, the grippers opening at the moment of contact and letting it go, so as to allow the punch to perform its duty of compression. As the lower ends of the grippers open, the upper ends close upon another piece of the lead rod, and the train of operations described are again repeated.

The grippers are worked by means of the lever, P, and cam, P^1, upon the outer revolving shaft, K, the form of these cams being such as to give the requisite travel to the lever at the proper time. An adjustable stop screw, Q, is placed at the back of the grippers, F, to receive the end of the lead rod, and regulates the length of the piece to be cut off. The feeding rollers, M, are set to give rather more than the required quantity of lead rod, which thus abuts each time hard against this stop. The metal, being soft, yields to the pressure, and in yielding prevents accident.

As the accurate dimensions of the bullet depend upon the correctness of the steel punch and die, they, of course, require the closest attention, and necessitate the greatest nicety in manufacture. The hollow of the die is made of the exact shape and size of the bullet, and has a moveable bottom connected with a spindle, R, moved by a lever, S, and cam, S^1, by means of which the bullet, when formed, is thrust out. The die is fixed in a holder, T, which can be adjusted by a set of screws, U, to a position accurately true with the punch. The punch, G, is screwed into the spindle, V, which receives a reciprocating motion from the eccentric, O. The punch, G, besides pressing the bullet into the die, also produces the hollow in its rear end, and as it retires, after having given its squeeze, the point is lubricated by the lubricator, W, worked by the heart cam, X. The escape of air from the die is provided for by means of a very minute hole drilled through the ejecting spindle, R. This hole permits its escape, and thus allows the lead to be solidly compressed into the whole cavity of the die.

If the hardened steel punch and the die, in forming the bullet, were permitted to come into absolute contact with each other, they would, sooner or later, destroy themselves, because, however rigid the machine might be, or, however perfect its original adjustment, there would always be a certain amount of yielding, under the severe strains to which it is exposed, and gradual wear and tear; which would, in course of time, destroy the die, or the punch, by bringing their mutual pressures against themselves. This is prevented from occurring as follows. The ends of the punch and die are so adjusted as not to come together by ·02 of an inch, and as the punch forces the lead piece into the die, which it completely fills up, with a very slight surplus, it forces out a film or thin rag of lead around the end of the bullet, at the junction point.

As the punch retires, a plate, Y, termed the "film plate," is made to rise immediately in front of the mouth of the die, by means of the lever, Z, and cam, Z^1. This plate has a circular hole through it, precisely the diameter of the finished bullet, which being ejected through this hole, whose edges are square and sharp, by the spindle, R; has this film, or fin of lead, cut off from it; the film dropping, and leaving the plate clear. The bullet now finished, is delivered through a shoot into a wooden box.

The motion for working the ejecting spindle is obtained from the lever, S, worked by a clutch cam, S^1, upon the end of the outer revolving shaft, K.

Several of these machines have now been in use in the Royal Arsenal, for about ten years, with great success, and from their simplicity, efficiency, and rapidity of action, can meet almost any demand, for small arm projectiles, at a cost much below that of any system there previously in use. Since 1853, nearly 500 millions of bullets have been made, at an average cost of 5½d per thousand, while previous to the introduction of these machines, the cost was upwards of 5s for the same number of bullets. The machines run at a speed of forty revolutions per minute, and, as before stated, each revolution forms a bullet in each set of dies—160 bullets per minute would, therefore, be turned out, or 96,000 bullets per day of ten hours. We understand that when these bullets, taken at random, are compared; their dimensions are not found to vary, in extreme, more than a fraction of an inch, scarce measurable by the finest instruments; and that they do not differ in weight one from the other, more than a fraction of a grain. The latter quality is as indispensable to good rifle military practice, as perfection of form.—En.

THE ROTATORY DISC BLOWING MACHINES.

By Mons. M. E. Fossey.

Illustrated by Plate 295.

We proceed to describe the construction of these machines, as shown in Plate 295, which appeared with the January part of this *Journal*. Fig. 1 is a plan of both engines and blast cylinders, which are a coupled or double set, arranged horizontally; the pistons of the blast cylinders being worked directly by piston rods passing continuously through the steam and blast cylinders. The main peculiarity consists in the construction of the ends of the blast cylinder, in which certain

Plate 295.

Fig 2

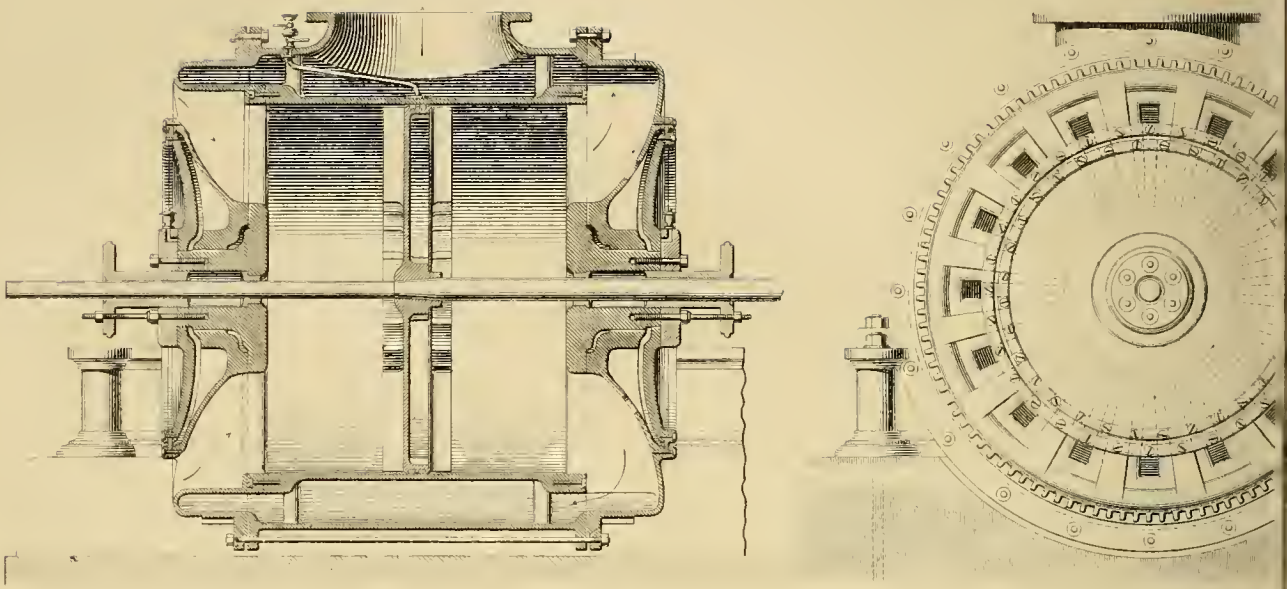
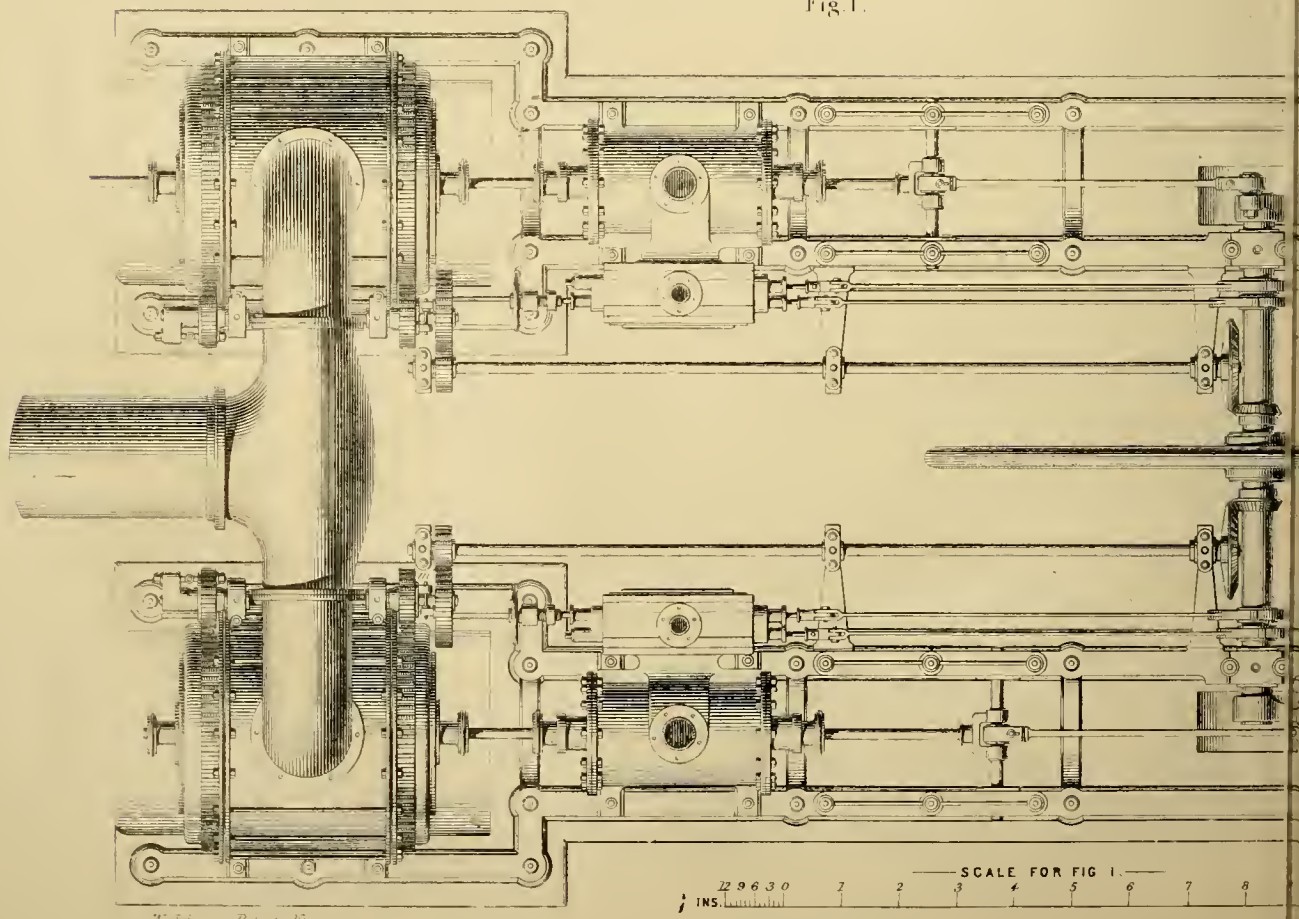


Fig 1.



W. Johnson Patent Offices
4 Wigtons Inn Heads & Glasgow

Fig 3.

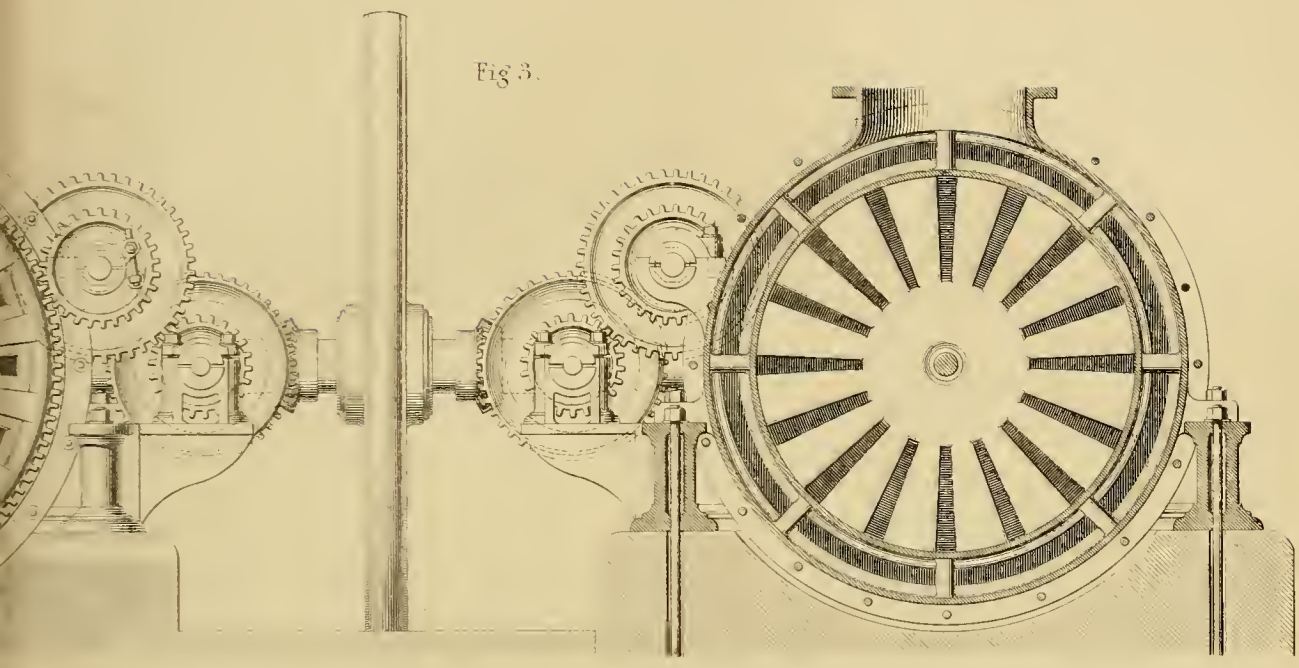


Fig 5.

Fig 6.

Fig 7.

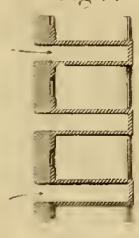
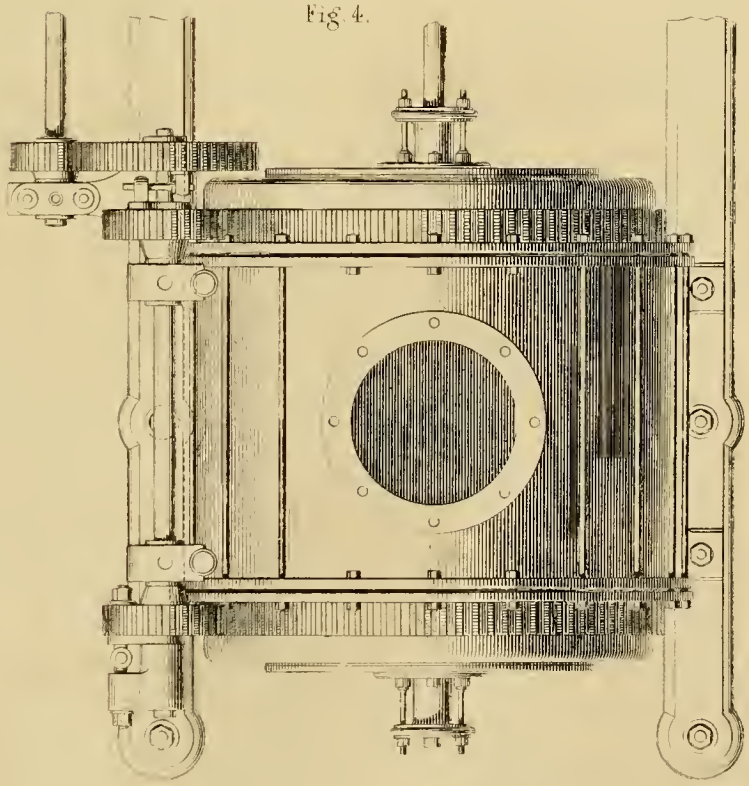


Fig 4.



SCALE FOR FIGS. 2 TO 7.

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ROTATORY DISC BLOWING ENGINES.

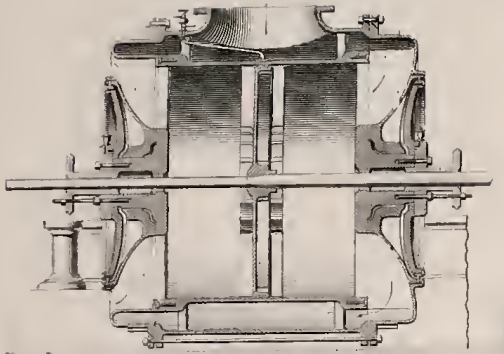
BY M. E. FOSSEY, PARIS.

ENGINEER.

Plate 295.

Vol. VII.

Fig 2



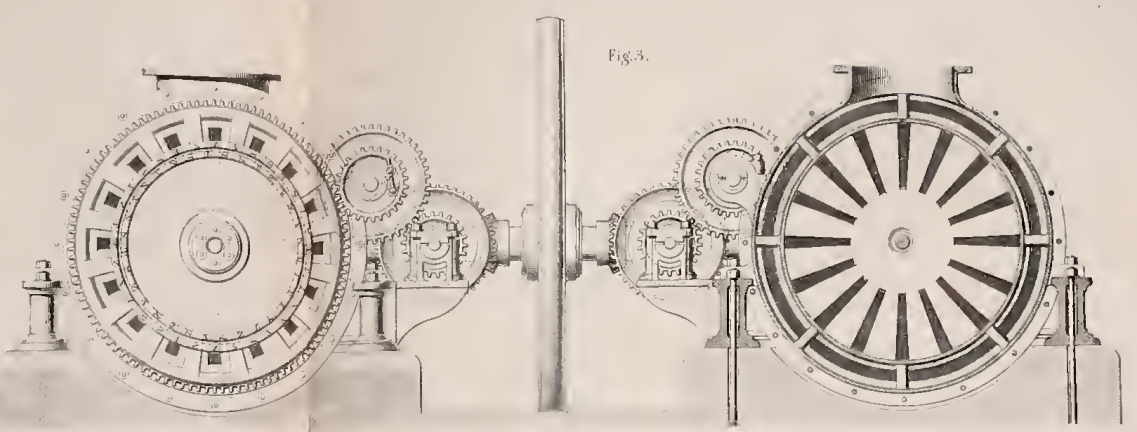


Fig 3.

Fig 1

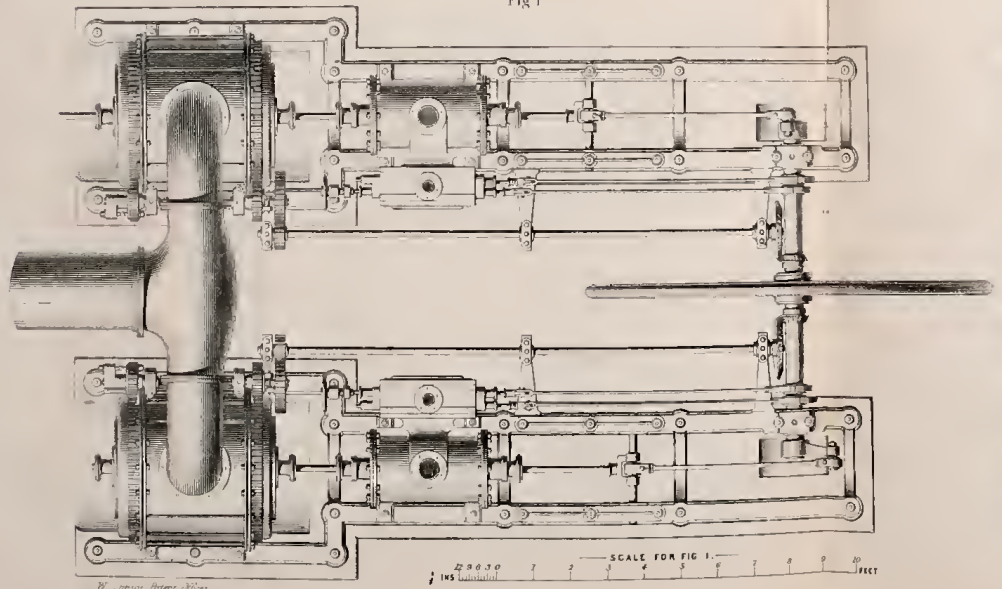
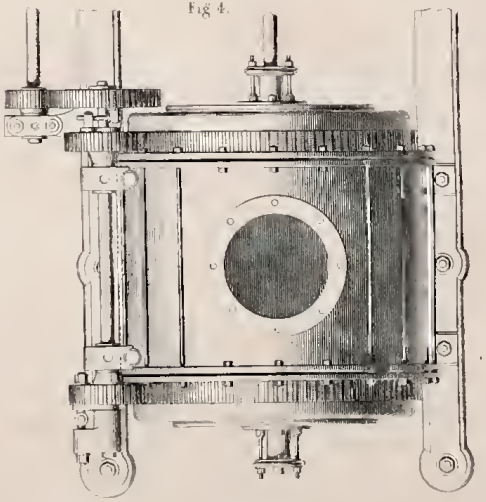


Fig 5.

Fig 6.

Fig 7.

Fig 4.



SCALE FOR FIG 1.

SCALE FOR FIGS. 2 TO 7

perforations are arranged, so that on continuous rotation being given to these ends round the piston rods as centres, they perform the functions of rotatory slide valves, and alternately open the opposite ends of the cylinders to draw in air, and close them when about to compress the air into the main. The engines are high pressure, without condensation, coupled upon a crank shaft common to both, with fly wheel in the mid-length. The arrangement of the cylinders and pistons are, as usual in horizontal engines, with guide slides for the piston rods, at the connecting rod end. The piston rods pass through the cylinder covers at both ends, and form, by continuation, the piston rods of the blast cylinders.

The valve gear consists of a steam and exhaust slide, and a cut off slide, with variable stroke, on the system of Meyer; these are moved by separate eccentrics; the steam enters by the pipe upon the bonnet, and is blown off by the larger one on top of the cylinders. The engines do not appear to be provided with feed pumps or governors, and they do not demand further description. Each blast cylinder, secured coaxially, and upon the same common bed plate with the engine cylinders, is cast in one piece, with an external envelope, or jacket cylinder, the two being held together by studs cast at intervals between. This may be seen in fig. 2, which is a vertical longitudinal section to an enlarged scale of one blast cylinder; and, also, in the right hand part of fig. 3, which is a transverse section of one cylinder at mid-length; this annular interspace is in communication with the main pipes by which the air is discharged. The main pipes, from both cylinders, are united by a T piece into one common discharge main of double the area of either branch. The opposite ends of the blast cylinders are identical in construction, except that the stuffing boxes at the ends furthest from the engines are a little smaller than those at the other ends, inasmuch as the prolongation of the piston rods through the former is only to play the part of guide to the blast pistons.

Each end of the internal or bored cylinder is closed by a fixed disc, secured to it by screws round the circumference, and which carries the long stuffing box for the rod in the centre; the annular space between, is perforated by sixteen sector-shaped apertures, shown in internal elevation, at the right hand cylinder, fig. 3, and in section in fig. 2, and arranged very much like the apertures, in common circular brass ventilators, for admitting air to rooms, etc. The external surfaces of these discs are faced and ground, and are in the same plane with the faced flanges, which terminate the ends of the outer or jacket cylinders. Over, or external to these fixed discs, are placed the hollow revolving discs, which are also perforated with corresponding apertures, and faced and ground, so as to work round smoothly, and with as little friction as may be, against the inside discs; being held in place by a circular ground hoop, which comes over the V shaped turned outer edge of the revolving disc (and which hoop or ring is bolted to the flanges at the ends of the outer cylinder), and also, at the centre, by a circular gland secured to the fixed part of the stuffing box. The form of these revolving discs is peculiar, and not easily, or at once, imagined. In effect, each consists of an annular circumferential cavity, which is equal in width radially, to the space between the outer and inner cylinders, with which it is always in communication.

Between this, and the central boss, at the stuffing box, there are the sixteen sectorial and equidistant apertures through the disc, as already described, and between these an equal number of blank spaces, each so formed as to make a tube of communication, at the proper moment, between the sectorial apertures in the cylinder ends (or fixed discs) and the inner wall of the annular circumferential cavity, i.e., with the air delivery space, between the inner and outer cylinders; this will be seen in fig. 2, wherein the left hand end of the cylinder is in free communication through the sectorial apertures, with the open air, while the opposite or right hand end of it has a communication established between the cylinder, and the air delivery passages external to it.

Rotation is given to these disc ends, as may be seen by inspection of the several figures, by a double train of toothed wheels; to the first of which, motion is given from the bevel pinions on the crank shaft of the engines, and the last of which communicates the motion to the discs by spur gear cast upon the outer circumference of the annular part of the discs.

There are sixteen apertures in each disc, and as each one of these must be uncovered, and each one covered, at opposite ends—during one double stroke of the blast cylinder piston—so each disc makes $\frac{1}{16}$ of a revolution during the time of one such stroke, or one entire revolution for sixteen double strokes of the engine. The speed of the engines here shown—which are those that were exhibited at work in the West Annexé at the late Exhibition—was regulated at seventy-two revolutions per minute, so that each disc only revolved at the slow rate of $4\frac{1}{2}$ turns per minute.

The speed of the piston was about 330 feet per minute, the stroke being 0·70 metres = 2·296 feet. The united area of the sectional apertures at either end was one-fifth the area of the cylinders, so that when partly open to the atmosphere, the air entering the cylinder must, to follow the movement of the piston, rush through, at the rate of 27 5 feet per second.

Let us now follow the movement of the machines, to complete the idea of the functions of these discs.

Referring to fig. 2, and assuming the piston about to start, and to traverse from left to right in the cylinder, so that the latter should be commencing to take in air at the left hand end and discharging it at the opposite one; the disc at the left hand end will be in such a position as to revolution, that a free passage for the air into that end of the cylinder shall be provided, by the course shown by the small arrows, while all communication with the cylinder through the annular cavity of the disc is cut off, the position of the passages being that shown in fig. 5; which, as also figs. 6 and 7, are partial sections taken circumferentially through three adjacent ports. At the other end (the right) of the cylinder, the disc is in the position, on the contrary, to give vent to the air compressed within the cylinder, and to discharge it into the annular space between the cylinders, but has cut off all communication with the external air; the position of the passages being that shown in fig. 7. Fig. 6 shows the momentary position of either disc, when the orifices are completely closed by them.

There remains but one structural point to notice further; a very ingenious device by which a considerable portion of the pressure of the compressed air upon the interior of the disc at the moment of discharge is relieved; whereby much of the friction that would otherwise result, opposing the free movement of the discs, is obviated. A central disc, distinct from that in which the passages are formed, is fixed concentrically and externally to the latter; at its circumference it is made good all round, to the passages disc, by the intervention of a zone of somewhat flexible sheet copper, gripped between two concentric lap rings of iron, screwed, the one to the passages disc, the other and inner one, to this (which we will call) the loose disc. This may be seen in fig. 2, and also in the left hand part of fig. 3. The centre part of the loose disc is secured inside the fixed gland or collar of the stuffing box, against which it bears in revolving. Between the concave end of the passages disc and this loose disc, a hollow space is obtained, and into this the compressed air is admitted by certain apertures, two of which are seen at the right hand end of fig. 2. The effect of thus admitting the compressed air is to balance its pressure, on both sides of so much of the area of the passages disc, as is equal to that of the loose disc. The latter, of course, has no actual *range* of movement in the direction of the axis of the cylinder, but the flexibility of the copper uniting zone is sufficient to transmit the back pressure. Oil is used to lubricate the piston, which is metallic, and provided with blocks at each face, corresponding and entering into the sectorial apertures at each end, so as to avoid loss of blast space; and it is stated that the oil which has passed by gravity down to the lower side of the cylinder, and is gradually pushed off by the motion of the piston, is licked up by the revolving discs at their lower side, and found to sufficiently lubricate them.

Fig. 4 is a general plan, to an enlarged scale, of the exterior of one cylinder, and shows the gearing, etc.

The machine exhibited in London is stated by M. Fossey to have been suited for blast furnaces of the largest class, producing 25 to 30 tons of iron per day, and to deliver blast at a pressure of from 18 to 30 centimetres = from 7·02 to 11·7 inches of mercury. The workmanship was certainly creditable to its constructor, Mr M. L. Perard, of Liege; and the blast from the seven twyers with which it was provided, was quite one of the mechanical lions of the Annexé. These delivered from an air-regulating chamber of boiler plate, which was provided with a manometer gauge.

No experiments that we are aware of, however, were made, either by the indicator or otherwise, that would enable any precise judgment to be pronounced upon its "useful effect."

M. Perard, however, received a medal for it, "for originality of design, practical efficiency, and good work;" and another was awarded to M. Fossey, "for the invention," which one might have supposed included the originality of design.

The following are the chief advantages that are claimed by the inventor for this form of blast engine.

It is alleged that blast cylinders with clap or hinged valves, besides a direct loss of effort due to these, are in frequent need of repair by the shocks to which the valves are continually exposed in shutting hard; and that, to palliate this evil, the pistons are often limited to a low velocity, whereby a serious loss of effect is occasioned.

By driving the blast cylinders directly, and in an horizontal position, it is said, motive power is saved as respects a number of unnecessary intermediate parts, and that by a more rapid speed of piston, the dimensions of the whole machine may be reduced, and hence its first cost, as well as that of foundation.

The whole of these advantages, whatever they be worth, however, this blast engine cannot claim in particular. There are numerous horizontal blast engines driven directly and at high speed by high pressure engines, long at work, both in this country and in France, Belgium, and Prussia, &c.

Its real merits, whatever they may be, must rest upon the peculiar conformation given to its air valves, by which a continuous rotatory multiple ported slide, is substituted for any other form of valve—such as the older flap valves of leather and iron—various sorts of metallic valves, or those of vulcanised india-rubber, shutting against gratings of metal, which have been largely employed in Germany.

It is said of these machines, that "they obviously cannot require important repairs." Now this is just the point that seems to us so far from obvious, as to be something more than doubtful.

We admit and render due homage, to the skill with which all the parts have been here mutually adjusted and connected. We notice the long stuffing boxes, and the stiff piston rod, although this bears an unusually heavy piston; and we give due weight to the ingenuity with which a large part of the air pressure is relieved (as we have described) from the frictional surfaces of the revolving discs, and how, by causing the last pinion that works into the toothed gear of the disc, to turn at the engaged side, *from below to above*, part of the dead weight of the disc is relieved by its constant lift, and so the excess of friction and of wear at the lower half of the circumference of the disc, and its tendency to fall lower thereby, are also relieved. But all this goes but a short way in removing what appear to us insuperable objections to this construction. It is a matter of principle from which there is no escape, that no two flat discoid surfaces, (circular plates or portions of such) however perfectly fitted as perfect planes, by scraping or grinding, &c., can be caused to rotate in contact with each other upon a fixed common centre, and continue for any considerable time to remain in contact, except at that centre. The friction is the same (as measured by the pull necessary to overcome it,) for every square inch of the whole surfaces applied, being simply as the pressure of application, and independent of the velocity of sliding motion; but the wear and tear, due to the friction, or the abrasion of surface, is *nothing at the centre, and a maximum at the circumference*, depending, as it does, upon the pressure of application, (the state of the surfaces being always supposed the same) and upon the amount of rubbing, *i.e.*, the extent of the surfaces passed over in a given time, so that the tendency is for the two flat circular opposed planes, *to wear each other into the surfaces of two cones* of very small altitude, whose apices at the common centre of motion shall be applied point to point. This truth, or rather the neglect of it, has in fact made shipwreck of nine-tenths of the various schemes from time to time proposed, for rotatory steam engines, and equally of several proposed forms, of rotatory or reciprocatory, round or centre cap-slides, for steam valves. Such a form of wear must inevitably, and not slowly occur, in this case. The wear of the disc faces will be much more rapid nearer the circumference than around the central parts and stuffing boxes—the less worn parts of the latter presenting a rigid obstacle, to the remaining longer face to face, of the circumferential parts of the disc—a continuous loss by escape of compressed air backwards, from the mains into the cylinder at its *open* ends must result.

But this is not all. If the applied faces of the originally flat discs were *uniform* surfaces of metal, the amount of wear would be, *quam prox*, alike in any circle, round the centre of rotation; but here the rubbing surfaces consist of alternate, sectorial apertures or opes, and of blank surfaces of metal. The wear across any one of the latter, taken in the direction of any circle of its revolution, will not be uniform either —each metallic section will have its surface *most* abraded nearest to that side at which the rubbing plate (or disc) *first* meets it, in coming round; the final tendency being, to wear every such sectorial surface into a skewed plane of double curvature, and twisted something like the vane of a windmill or the blade of a screw propeller, though, of course, greatly less in degree.

These objections become formidable, when we bear in mind that every blast engine is continually drawing in fresh supplies of dust and grit with the air, and lodging this grinding material, against the oiled faces of these discs, to which it must inevitably adhere, and become like emery upon a lead lap. Those who are practically acquainted with blast engines, know full well that this dust, so drawn in, is no imaginary evil, but that it frequently, in horizontal and quick moving blast cylinders, produces, in dry and dusty weather, although every precaution be taken, such an amount of rub and friction, between the piston and cylinder, as to set the whole machinery and framing in vibration, and produce a loud roar; an effect called "didtbering," in the North country; "romping," in South Wales, and which, if not speedily remedied, by stopping and wiping out clean, and re-adjustment, would endanger the tearing to pieces of the machinery.

We may pass, as comparatively unimportant, the structural difficulties that are here involved, in getting easily and rapidly at the inside of the blast cylinder, or doing anything to the piston; and equally so, the highly irregular nature of that portion of the wear of the discs, that will be produced by their *descent*, parallel to their own faces, by the greater wear at the lower semi-circumferences, due to their own weight.

Let us, however, conceding fully the advantages to be hoped for, from the substitution of an efficient *slide* valve for any *clap* valve, examine a little how far the form and proportion of slide here contrived *is* efficient; even suppose it could be maintained free from the derangements we have referred to.

The united area of the passages here is given at one-fifth of that of the blast cylinder; this is the same both for inlet and outlet.

Now, in British blast engines, with clap valves, *one-half* the area of the cylinder is preferred for the area of the inlet valves, and at this large size, the valves practically close without any sharp or injurious blow, although the speed of the piston be nearly double that of M. Fossey's engine; and *one-fourth* the area of cylinder is looked upon as desirable amongst those who have had most special knowledge of this subject, as desirable for the outlet valves; although it should be stated there are plenty of defective examples of valves a great deal less —even as low as $\frac{1}{8}$ or $\frac{1}{9}$ the cylinder area. Here, however, we have the passages only one-fifth when *fully* open. Now, the rotation of the disc valve is uniform, and each, at opposite ends, moves over one-sixteenth its circle, i.e., closes one, and opens another set of sectorial apertures during the stroke. The result is, that at some intermediate part of the stroke, (it may be the middle, or before, or after it, according to the way the gear is set), and that not far removed from the most rapid part of it, the inlet and outlet apertures are actually reduced to one-half shut, or to *one-tenth* the area of the cylinder. And it is to be remarked as large an area of aperture has been obtained by M. Fossey's skill, as, perhaps, it is possible to give with his construction. If we add to this smallness of opening, the extremely unfavourable *form* of these long, narrow, *slot*-like, sectorial apertures, for passing an elastic fluid, without a serious *co-efficient* of *contraction*, and equivalent loss of force, and that this contraction becomes greater and greater, from the moment when the aperture is fully open, to that when it becomes closed, by the *narrowing* of the slot, on the *scissors*-like approach of the edges of the opposite faces; we cannot avoid coming to the conclusion that nothing has, in reality, been gained by this ingenious and skilfully wrought out device of M. Fossey's, but much the contrary. This conclusion was amply corroborated to any practical mechanic who attentively listened to the tremendous *whizz* with which the air was sucked in and squeezed out from the cylinders that were at work in the Exhibition. We must reserve the further consideration of this subject until our next.—Ed.

THE PORTABLE ENGINE—PAST, PRESENT, AND FUTURE.

PART II.

One of the very first, if not the first, portable steam engines introduced to the agricultural and general public, was one made by Messrs Ransomes & May, of Ipswich (now Ransomes & Sims), and exhibited in 1841 at the Liverpool meeting of the Royal Agricultural Society of England, where it received special commendation by the judges. Fig. 10 is a side elevation of the same, together with a steam threshing machine; the dotted lines show the latter when not at work, and ready for travelling. This engine was constructed on the disc principle; it was afterwards altered to a self-propeller, and, in this form, exhibited at the Bristol Meeting of the Royal Agricultural Society of England, in the year 1842, when it created an immense sensation, and was awarded a prize of £30 by the judges. The next step in this direction, by Ransomes and May, was the construction of portable engines of a different type, more like that of the railway locomotive boiler, with a horizontal engine bolted down on the top of it. The boiler had one large oval flue within the fire-grate, at one end, and small return tubes, around and above it, of the common sort, as shown in the transverse section of this boiler, in fig. 11. This was in 1846. The engine rested on a massive bed plate, screwed to the top of boiler, and was, no doubt, a pretty good specimen of a portable engine then; but, we cannot, for all that, admire the general appearance and construction of it: for instance, the cumbersome fly wheel, with arms and rim bolted together, as if it were some

Fig. 10.

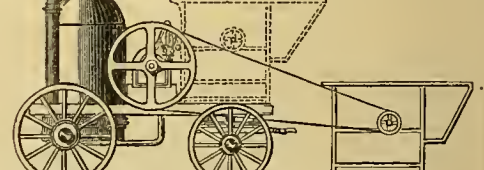


Fig. 11.

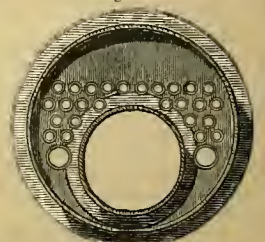
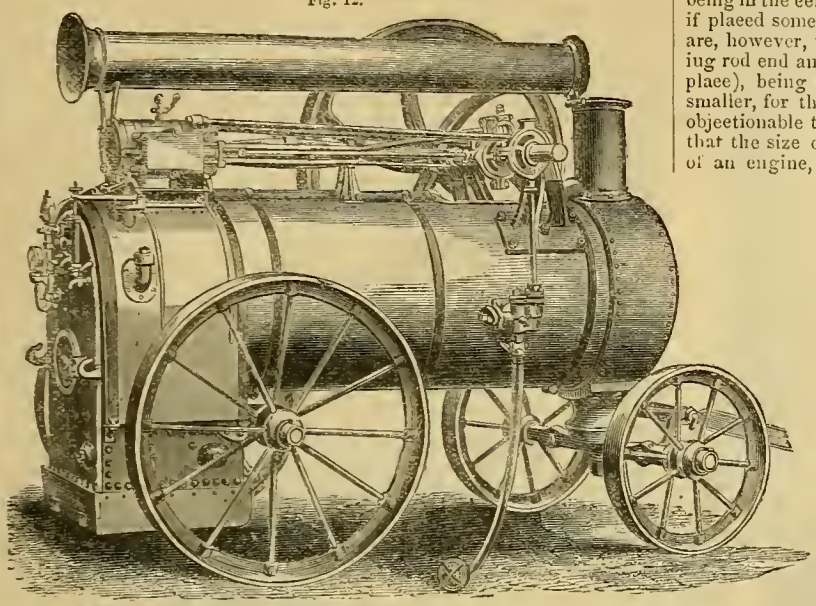


Fig. 12.



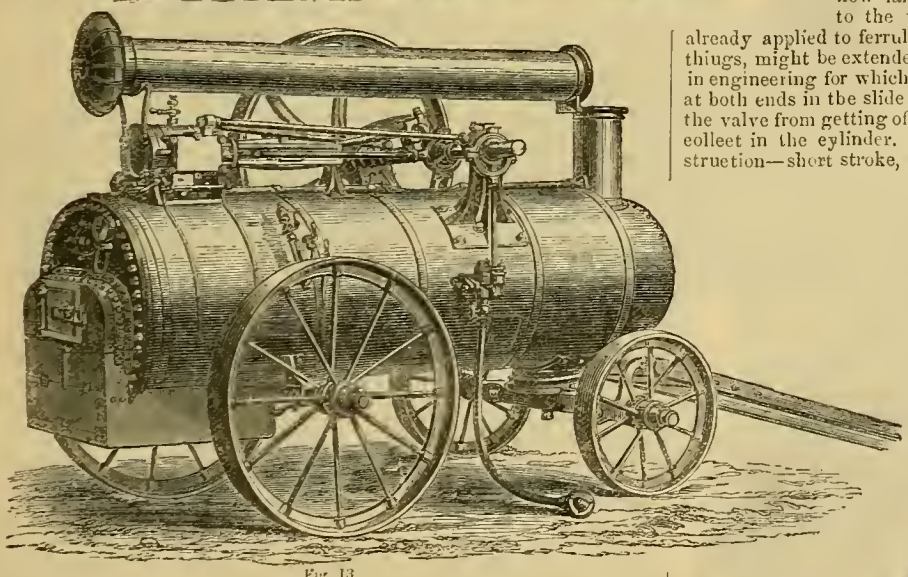
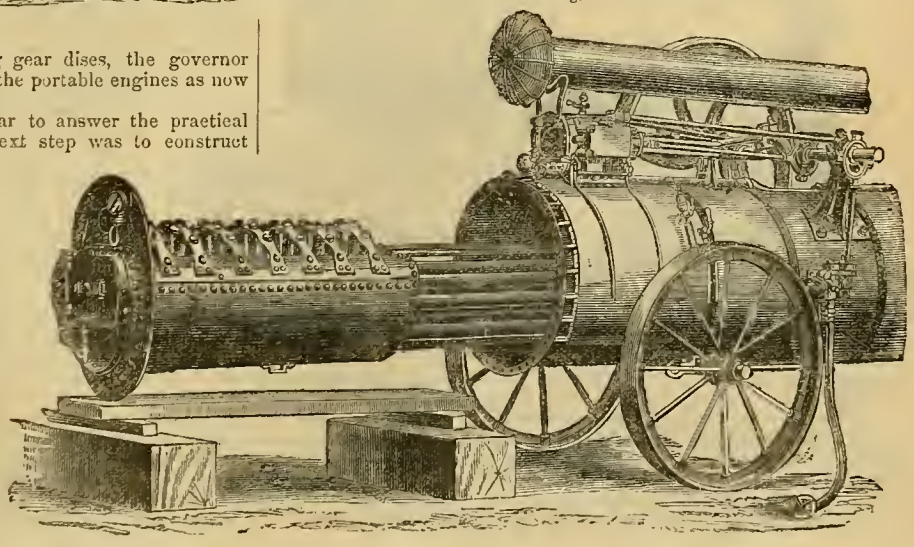


Fig. 13.

12 feet in diameter, the very large looking gear dises, the governor gear, ete —all this eontrasts strangely with the portable engines as now made by this and other firms.

This eonstruetion of boiler did not appear to answer the praetieal reqnirements fully, and, we believe, the next step was to eonstruct them in a form more nearly approaching that of the railway locomotive, with a pair of eylinders plaeed below the boiler, and the engine made self-propelling. Tbis, however, was very shortly superseded by the general form now in use for this elass of engines. In fig. 12 is given an engraving of an 8-horse-power portable engine, as now made by Messrs Ransomes and Sims. It is different from that of most other makers, in having the engine plaeed in the centre line of the boiler. The objeet of plaeing it somewhat out of the eentre-line, is, we believe, to get the engine a little lower, allowing the erank shaft and eonneetiug rod end just to clear the boiler lagging, and to make the transverses train which the shaft is exposed to act nearer to a bearing; the steam and exhaust pipe being in the eentre line of boiler, makes the eylinder a simpler easting than if plaeed somewhat out of the eentre line. Ransomes & Sims' engines are, however, very eompaetly arranged, no more play between eonneet-iug rod end and exhaust pipe, (whieh has a flattened eopper bend at this plaee), being allowed thau is neeessary; and as their eylinders are smaller, for the same power, than other manufaeturers, makes it less objeetionable to the plaeing of them in the centre. They argue justly, that the size of eylinder is one element only in estimating the power of an engine, the evaporative power of the boiler being the most important. It has been a question of diseussion with engineers for some years, whether it is not for most purposes more advantageous to have a quieker speed and a small eylinder, than a slow speed and a large eylinder, when the important point of balaneing the engine well is attended to; and this has been doue to so far in this ease as to have a eounter weight on the fly wheel rim. But the fly wheel and other working parts might be mueh lighter in such engines for the sake of durability and regularity. These engines are, however, very well eonstrueted generally, and the material and workmanship unexceptionable. The fire box and tube plates are of Low Moor iron, and the other plates in the boiler are of best Staffordshire. The boilers are strongly stayed, the tubes a good distanee apart, and the whole boiler is lagged with wood, exeept on front and baek of fire box, where it cannot eonveniently be done. There is, however, no felt elothing, as on many other portable engines. The hinge joint on the ehimney is made of malleable east iron, a material now largely manufaetured by this firm, and it appears to the writer that this mode of preparing east iron, already applied to ferrules for tubes, to spanners, tube bends, and other things, might be extended with great advantage for very many purposes in engineering for which it is not yet thought of. The slide rod is guided at both ends in tbe slide jaeket, without, at the same time, preventing the valve from getting off from the faee to a slight extent, if water should eolleet in the eylinder. The feed pump is a neat little piece of eonstruetion—short stroke, large valves and passages as it ought to be for quiek speed; a two-way hollow eoek is placed between the delivery valve and boiler, so as to admit part or all of the feedwater being turned out into the atmosphere instead of into the boiler, thus enabling the driver to keep the pump eontinually working and the barrel and valve box full of water. The loeking gear, consisting of a spherieal dise and eorresponding hollowed easting, allows the front wheels to suit themselves to any unevenness of the road without throwing any strain on the engine The governor gear is as simple as ean be, eonsisting of one single lever, attaehed at oue end to the throttle valve spindle, the other end working direetly into the sliding and revolving sleeve on the governor spindle. The guides are of east iron

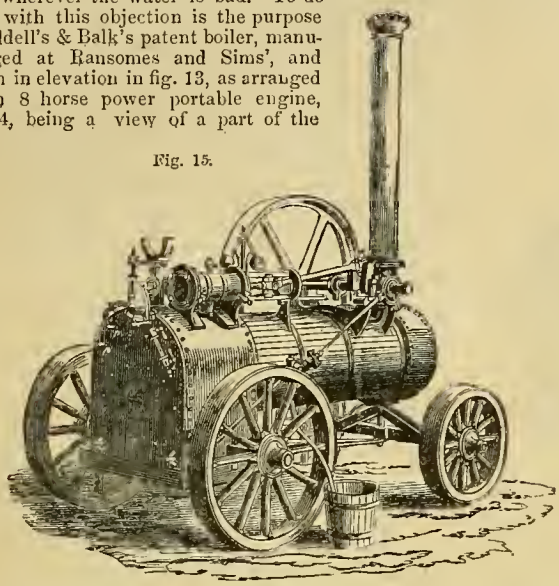
Fig. 14.



as well as the guide blocks, but the latter are not adjustable. The slide eccentric is easily adjustable for altering the expansion to a small extent and reversing the engine. The slide is very carefully constructed, and has enough of unequal lap on both ends as to ensure equal cut off. The crank shaft brackets are strongly stayed to the cylinder.

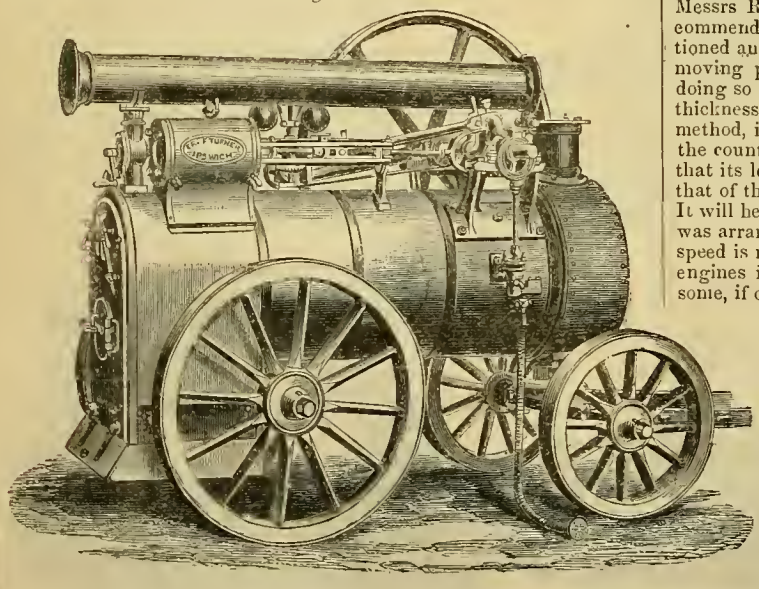
One serious objection to all multitubular boilers is the difficulty in thoroughly cleaning and examining them inside, which is required very often wherever the water is bad. To do away with this objection is the purpose of Biddell's & Balk's patent boiler, manufactured at Ransomes and Sims', and shewn in elevation in fig. 13, as arranged for an 8 horse power portable engine, fig. 14, being a view of a part of the

Fig. 15.



boiler of the same engine, showing the tubes as in the act of being removed. From the latter view it will be understood how the tubes, with their tube plates, are made moveable in a mass on one end plate of the boiler being unscrewed from the outer angle iron on the shell of the boiler, and the tube plate at the smoke box end similarly unscrewed from a stout wrought iron ring, which is riveted to the inside of the shell. These two joints being faced up, and a good job being made of it, there

Fig. 16



is no objection to this plan, which admits of cleaning and examining the inside of the boiler much more effectually than it ever is possible with a common multitubular boiler. The top of the firebox is flat and strongly stayed by wrought iron bars riveted to it, with thimbles round the rivets. The distance between these stays is the same everywhere; if subjected to a severe external pressure, it would be found that the top in the middle of its length would bulge in, whereas the front plate and tube plate of firebox would prevent this taking place at the ends, where it is much stronger on that account, as has been demonstrated by Mr Fairbairn's experiments on the collapsing of tubes, and which would, it is thought, hold good in this case too. A somewhat similar plan, but with return tubes, and consequently with one joint only, has been patented here and in France, anterior to this patent, and a specimen of the same was exhibited amongst the French machinery at the International Exhibition of last year, which will be mentioned further on. The weight of the 8 horse power portable engine is 63 cwts., without water in the boiler, and it consumes about 7 lbs. of coal per horse power per hour, the nominal horse power being given off by 45 lbs. pressure in boiler, and double that by 60 lbs.

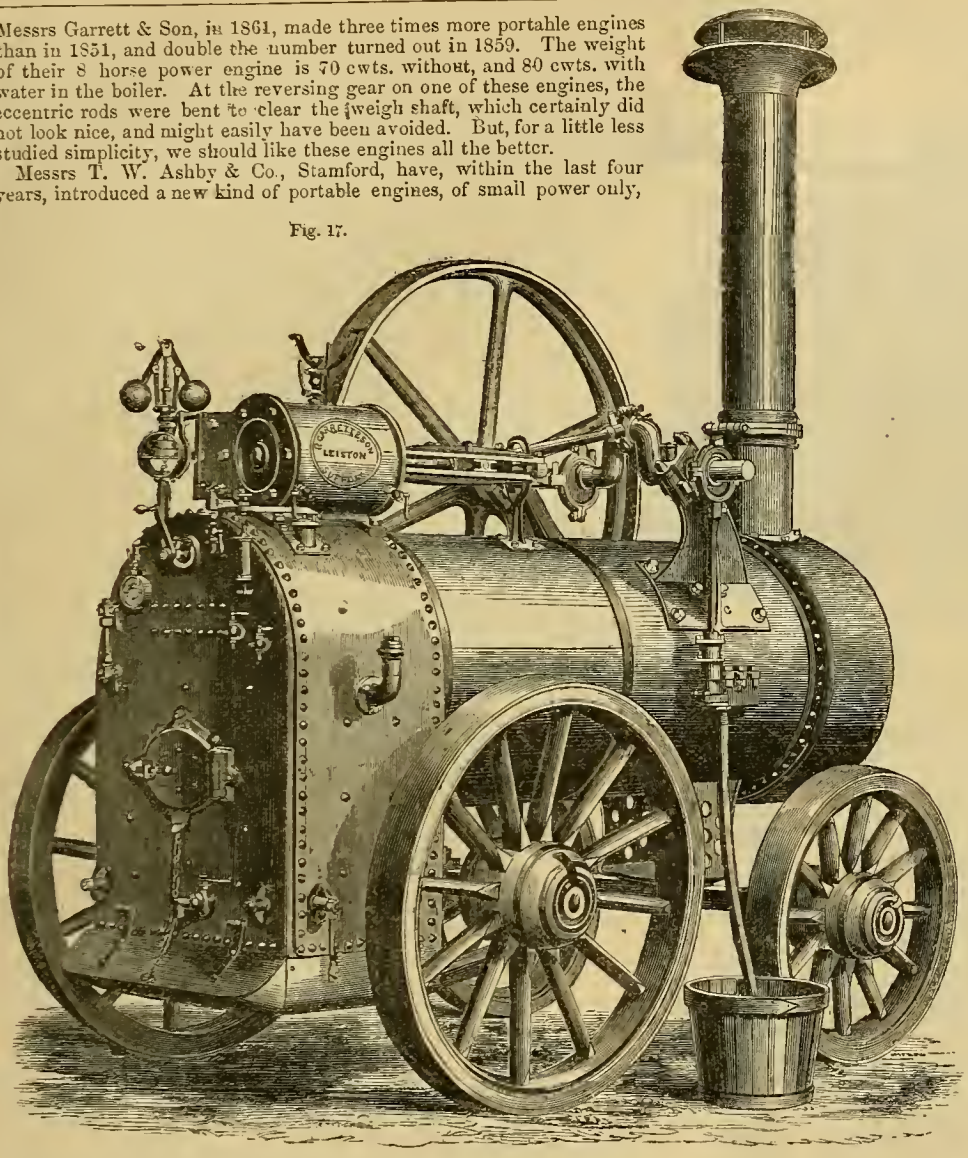
Much of what has been said about the present engines of Ransomes & Sims' may also be applied to those made by L. R. & F. Turner, of Ipswich, who manufacture a most simple and useful style of engine. Their first portable engine was made in 1849, and was of 6 horse power. The boiler was of larger proportions than their present ones of the same nominal power; the cylinder was placed in the vertical centre of boiler, with the slide valve above it, thus necessitating an intermediate weigh shaft for working it. The engine was provided with a coil feed water heater; the feed pump was fixed to the side of the cylinder, and was driven from the cross head directly. In 1851, they made a somewhat different boiler for their portable engines, the fire box having a water space underneath the grate. This engine is shewn in fig. 15. Since then, they have employed the common locomotive boiler, with a raised fire box for engines of 6 horse power and upwards, and the fire box flush with the barrel for smaller engines. Their present 8 horse power engine weighs 70 cwts. Their 6 horse power engine, as now made, is shewn in fig. 16. The cylinder is slightly on one side of the boiler. The starting and safety valves are in the same piece of casting, and the top of it serves as support for the chimney. This is simple enough, but it is preferable to have the starting valve inside the boiler, as it is thus kept under nearly the same circumstances, the steam keeping all the parts equally expanded and well lubricated, whatever the outward heat or cold of the atmosphere may be. The feed pump has two delivery valves, so that if one should accidentally stick, the other may act. For the prevention of smoke, the fire box and burn plate are perforated with small holes. There is no counterweight on the flywheel of this engine, nor any means of adjusting the guide blocks. Formerly these makers used to provide their engines with feed water heaters, but they have now given them up, as they were found more complicated and troublesome to manage by the engine driver than any advantage gained; but there is no doubt that a simple feed water heater is certainly very recommendable; simplicity, however, has not been looked to in the construction of the governor gear. The tubes in the boiler are well arranged and widely apart.

Fig. 17 shows an 8 horse-power portable engine as now made by Messrs R. Garrett & Son, Leiston Works, Suffolk. There are several commendable features in this engine, which is generally well proportioned and well made. In mentioning the mode of counterbalancing the moving parts of this engine, it may be stated that the general way of doing so in portable and stationary engines, is by casting an additional thickness on the fly wheel rim. However, there is an objection to this method, inasmuch as at different speeds of the engine the momentum of the counterweight will be different, and if it is not put in such a place that its leverage, or the distance of its centre of gravity is the same as that of the crank and connecting rod end, its effect will be disturbing. It will be too heavy for any increase of speed above that for which it was arranged, and, vice versa, for any slower speed. In practice, the speed is not so irregular, if the governor acts properly, but with portable engines it is seldom that this point is so fully attended to as to prevent some, if only momentary, variations in speed, and a little thumping of the moving parts is the consequence. Messrs R. Garrett & Son have the counter weight placed on the fly wheel, so that the weight and leverage correspond with those of the moving parts of the engine which are to be balanced, which is in accordance with correct principle. The fire box is not very strongly stayed, having ¾-inch screwed stays, from 6 to 9 inches apart, at the sides of fire box, and 8 to 9 inches generally. Instead of having two or three longitudinal stays, with nuts inside and outside at the upper part of the fire box end, there is only one 1¾ inch stay fixed between two pieces of angle iron riveted to the plate. The fire box is not lagged or clothed, but the barrel of the boiler is wood lagged. Messrs Garrett used, some years ago, Horton & Kendrick's patent corrugated iron fire box, but gave it up again on account of the great extra cost. The exhaust pipe is carried outside the boiler, but being out of the vertical centre line with it, does not at all add to the symmetry of the engine. The rest of the details of the engine are generally simple, strong, and well proportioned. The cylinder is cast in one piece with the slide valve box. The feed pump has two discharge valves to insure its effectual working. The firm is doing a good trade in portable engines, sending many to foreign countries. To show the increasing demand for this class of engines, it may be mentioned that

Messrs Garrett & Son, in 1861, made three times more portable engines than in 1851, and double the number turned out in 1859. The weight of their 8 horse power engine is 70 cwts. without, and 80 cwts. with water in the boiler. At the reversing gear on one of these engines, the eccentric rods were bent to clear the weigh shaft, which certainly did not look nice, and might easily have been avoided. But, for a little less studied simplicity, we should like these engines all the better.

Messrs T. W. Ashby & Co., Stamford, have, within the last four years, introduced a new kind of portable engines, of small power only,

Fig. 17.

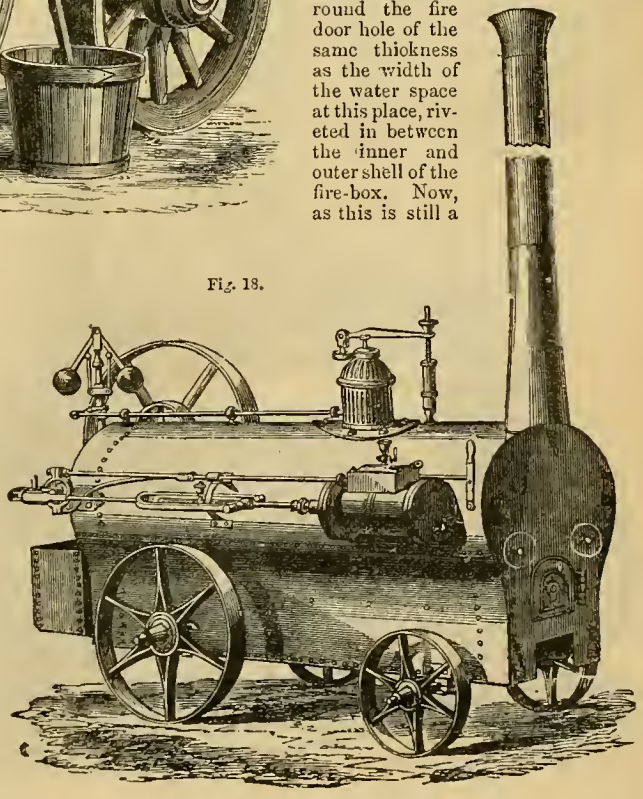


but useful in their way. Fig. 18 shows one of their 2½ horse power engines. Whether this style of boiler is the very best for such a size is questionable, but that the locomotive boiler would not be the best for such small dimensions seems obvious, by reason of the small fire box and imperfect combustion in consequence. These engines are very simple and cheap, but the workmanship is rather below the average. The construction of the boiler does not admit of much space above the grate, but there is a good length of run for the flame before returning through the upper return tubes; the water line is also wide, so as to prevent priming. The flat parts of the boiler are not very strongly stayed. The cylinder being fixed to the side of the boiler, and the absence of an outer bearing for the crank shaft, instead of which there is a common over-hung crank, which causes the slide to be on the top of the cylinder, and the slide eccentric between the crank and the bearing; if the slide valve box, as is done sometimes in French locomotives, were laid in an inclined position on the top of the cylinder, the unpleasant side pull would have been prevented, which now must take place, owing to the circumstance that the slide rod is horizontal, and its line of thrust considerably above the centre line of the crank shaft. The feed pump seems much too large, the engine being small; but, on the whole, this engine is good, and easily managed.

In passing over the common type of portable engines, we next notice an engine manufactured by Messrs Brown & May, Devizes, illustrated in fig. 19. The details of these engines are good samples of simple and substantial construction, and the workmanship is very superior. As to the construction of the boiler, we should have expected to see the use of angle iron in the fire box discarded, as is mostly the case now. The staying is strong, and the stays well arranged; the tubes are rather longer than usual. There is a counter weight at the fly wheel boss, as it ought to be, but we do not admire the round guide bars for the cross head, especially as the brasses on the same are not adjustable. The fire box is not wood lagged or felted, and the axle boxes are not of the best construction. On referring to a drawing, we find that the steam, instead of being taken from all parts of the boiler, through a slitted or perforated pipe running inside along the top of the boiler, goes directly through small perforations in the boiler itself into a jacket around the cylinder, before entering the slide jacket. On the top of this steam jacket, the safety valve is placed, which also serves as a chimney support when the same is laid down. On comparing Messrs Brown and May's present engines with those made eight years ago, we find in this, as so many other instances, a marked improvement as to usefulness, simplicity, and better arrangement.

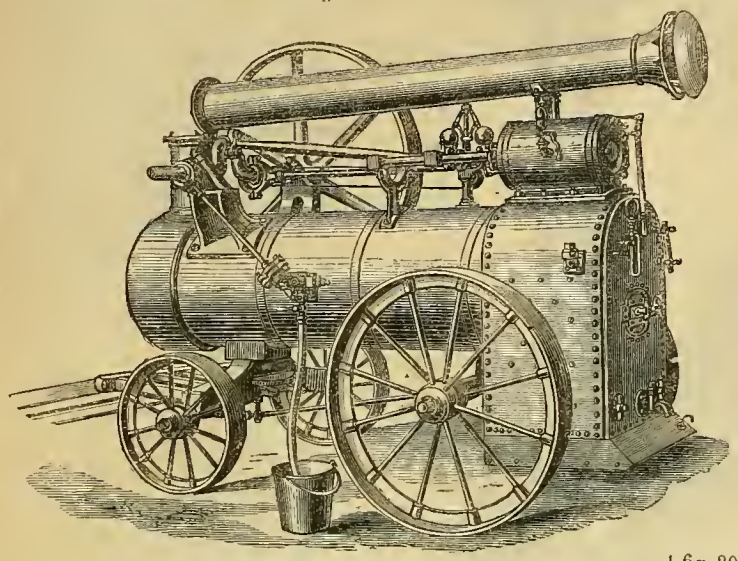
There are some good points in the portable engines made by Chas. Burrell, Thetford — among which may be mentioned the "feed water heater," regularly supplied without extra cost, and the crankshaft bearings, which have brasses adjustable sideways by means of set screws, and are generally well shaped. There are several points which we are obliged to censure in this otherwise good engine. First as to the boiler, the stays of which are too weak, and the tubes too closely packed, and that there is a ring round the fire door hole of the same thickness as the width of the water space at this place, riveted in between the inner and outer shell of the fire-box. Now, as this is still a

Fig. 18.



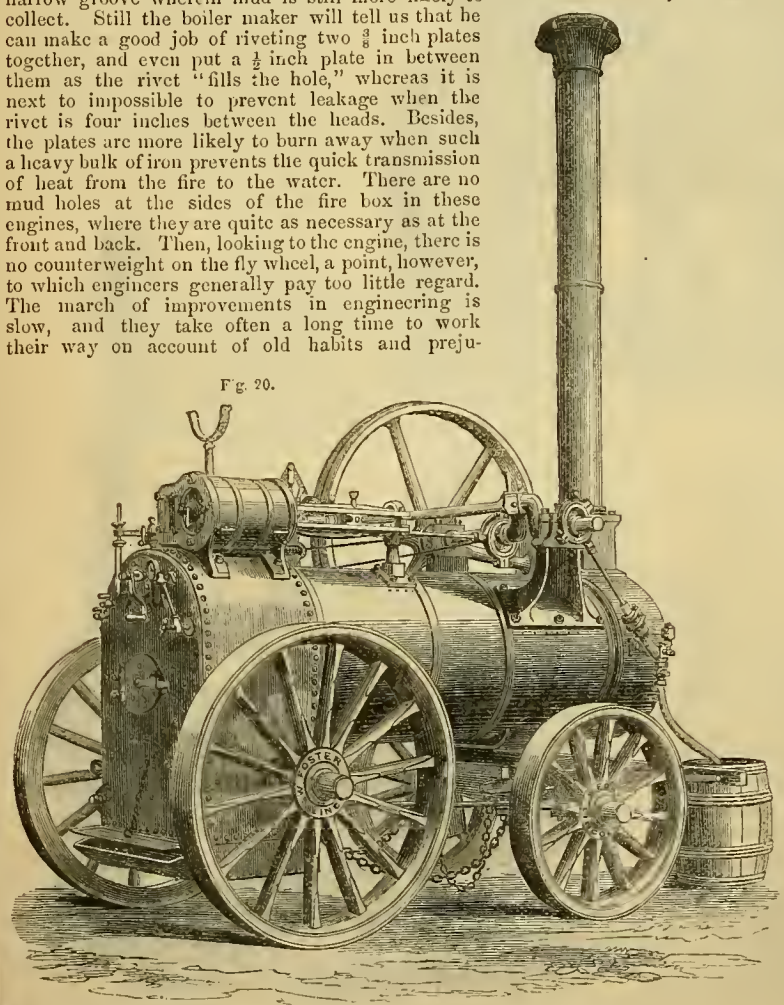
common practice with some locomotive and portable engine makers, it may be well here to mention that a practical boiler maker

Fig 19.



will always object to this plan, although it would appear at first sight that the mud collected in this space is less injurious by this construction than by bending the inner fire-box plate, thereby forming a narrow groove wherein mud is still more likely to collect. Still the boiler maker will tell us that he can make a good job of riveting two $\frac{3}{8}$ inch plates together, and even put a $\frac{1}{2}$ inch plate in between them as the rivet "fills the hole," whereas it is next to impossible to prevent leakage when the rivet is four inches between the heads. Besides, the plates are more likely to burn away when such a heavy bulk of iron prevents the quick transmission of heat from the fire to the water. There are no mud holes at the sides of the fire box in these engines, where they are quite as necessary as at the front and back. Then, looking to the engine, there is no counterweight on the fly wheel, a point, however, to which engineers generally pay too little regard. The march of improvements in engineering is slow, and they take often a long time to work their way on account of old habits and prejudices. The form of the connecting rod is rather out of date, and the greatest strength is not in the proper place; but other makers would do well to imitate the footplates on these engines which admit the driver to lubricate his engine properly and keep it clean. The weight of this 8 horse power engine is 65 cwts. without water in the boiler.

Fig. 20.



In the engines of Messrs Robey & Co., of Lincoln, which are not particularly well proportioned in respect to the engine itself, we find a construction of fire box which, although a little heavier, does seem to possess some advantages over many others. First as to the arrangement of the tubes, which is very good, and in the second place, as to the construction of the fire box, which has a water space not only at the sides, but also below the grate. It seems obvious that the sediment does less harm below the grate, from whence it can be readily blown off through the two blow off cocks as fitted in this case, than close to the grate where the heat is most intense. This plan must save much labour and expense in repairs. The practice of having a water space below the fire grate was at one time more general than now, but why it is so exceptional now we cannot tell, unless, indeed, it be on account of the greater difficulty in replacing a worn out fire box than in the common locomotive boiler, or the large fire door hole required to allow a man to get through it. The crankshaft bearings are adjustable sideways; but, although also tiresome, it must be noticed in this case also, the absence of the adjustment of the guide blocks, and the counterweight on the fly wheel.

Amongst the portable engines exhibited at the last Baker Street show, we particularly noticed a little portable engine, manufactured by William Foster, of Lincoln, illustrated in fig. 20, which, in general proportions and workmanship, came up to the highest standard, but we have not had an opportunity of seeing any engines from this firm since, and it is to be regretted that it was not represented at the Exhibition. This firm is not yet doing a very extensive business in portable engines, having been only 6 years in it, and in that time turned out 81 of them, but this is no criterion to judge from; and it is well to see that the supply answers to the demand, and that the customers get well served. These engines have adjustment on the crankshaft bearings sideways and at the flywheel side, also upwards and downwards. Guide blocks are adjustable by removing one or more of the thin brasses on the wearing side of the same, and substituting thicker pieces—a round about way, but still better than nothing at all. The feed water is heated a little as the copper feed pipe passes through the smoke box. The locking gear is of the usual flat disc shape. The fire box is not lagged or clothed. The working parts of these engines, such as joints, bolts and pins, governor arms and crankshaft in bearings, etc., are case-hardened, and the slide rod and throttle valve spindle are of steel. All the brasses are guaranteed to be pure copper and tin. The chimney is provided with a copper spark catcher. The roof stays on the fire box are of wrought iron. The weight of an 8 horse power engine is 65 cwts. without, and 78 cwts. with water in the boiler, which numbers seem to prove that the water spaces in these boilers are ample. Altogether, this engine is a very creditable piece of work; we could wish that the exhaust pipe was carried outside the boiler, and that the fly wheel had a proper counterweight the next time we see a specimen from these makers.

ARTIFICIAL ICE FOR INDIA.

The successful labours of Dr Gorrie and Professor Piazzi Smyth, in the production of ice for tropical climates, have been long ago fully recorded in the pages of the *Practical Mechanic's Journal*. It is more than possible that what these practical experimentalists accomplished, may have had some effect in bringing about what is now proposed to be done on the large and useful scale in India. Sometime back, some official correspondence arose between the Military Finance Department and the Government of India, originating in a suggestion made by the former to introduce the machine for making ice in the Bengal Presidency, with a view to supplying that luxury, or, in this country, necessary, to the European soldiers in barracks and in hospitals, of better quality and in larger quantities, also with more regularity, than is obtainable by the plain process of manufacture in vogue in the Mofussil, and which process, being liable to be affected by the weather, was admittedly uncertain. The corres-

pondence closed for the time with an order from Government to the Finance Department to institute inquiries as to the stations at which the machines, if imported, could be turned to the best account, not only in the supply of ice to the Europeau soldiery, but to the community generally, European and native. The result of the inquiries made by the several authorities who were addressed in the matter by the Finance Department, having been submitted to Government, the latter has declared its willingness to import three machines, to be set up at Allahabad, Lucknow, and Mean Meer, these stations being considered to afford the fairest and best field for their use. If the trials at these places prove remunerative to Government, as the department believe they will, then the machines are to be set up at others also, should private individuals not be willing to do so themselves. The cost of the machine and the charges for importing it being heavy, the experiment is to be made first at Lucknow only; and an iudent has been despatched to the home authorities for a No. 1 machine, which is capable of turning out four tons, or 8960 lbs., or 4480 seers of ice daily. The cost of the machine is estimated at £1365, bnt as it is worked by steam, it will have attached a 10 horse-power engine, with gearing complete; the boilers of the engine being adapted to burn fire-wood ouly, which is the only fuel procurable at Lucknow. A supply of 15 cwt. of ether (which is used iu the manufacture of the ice, the amount being equal to a year's consumption) and certain extra articles have also been indented for. These—that is the engine, ether, and extras—are estimated to cost £550. The entire cost, therefore, of the machine, its appendages and appurtenances, will be a little over £1900. Ten per cent. on this amount is estimated to cover freight, insurance, and transport charge to Lucknow. It has been ascertained that the machine requires to be attended to by a practical mechanic, one who understands its pecnliar construction and working; and to prevent any breakdown in India from ignorance of these matters, it has been suggested to the home authorities to place two men of the Sapper and Miner corps at the service of the inventors of the machine, who have expressed their readiness to instruct the men in the details of the machinery. On the article being put up in this country, these men will instruct others in the manner of its working. On arrival at Lucknow it will be placed under charge of Captain Chamberlain, superintendent of Thuggee. The daily cost of working it is estimated at 22-8. At this rate, and with the daily out-turn of ice as 8960 lbs., the rate of sale will be 6-2 9, or three seers per pice, thus placing ice within the means of the poorest who from sickness may need it. To utilize the experiment as far as possible, it is proposed to send ice during the seven hot months of the year, by relays of bearers, or by Government cattle, from Lucknow to Roy Bareilly and Seetapore (stations in the neighbourhood) for the use of the troops, and such of the community at those places as wish for it. It is estimated, that after setting apart a fair proportion of daily out turn for the consnmption of the troops, full one-third will be available for the public.

PAPER CUTTING MACHINE.

By Messrs D. & J. Greio, *Engineers, Edinburgh.*

Since the expiration of the well knowu patent held by the late Mr Wilsou until the year 1854, a great variety of paper-cutting machines have been introduced into manufacturing practice. Most of these have been coarsely and cheaply made, and, in consequence, very inaccurate; but with one great advantage—viz., that of a continuous motion—which none of those made by Mr Wilson possessed.

The machine now before us, and as represented in our perspective engraving, is adapted for cutting all kinds of writing and printing papers, also for bookbinding and stationery work, which require the utmost accuracy. One great improvement is the adoption of the diagonal over the vertical movement, as the latter, without coustant adjustment, never produces a clean *vertical* cut.

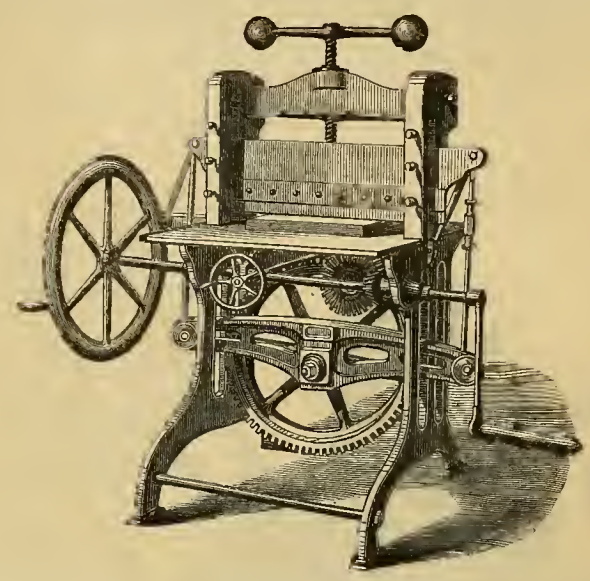
Another improvement to be noted is the introduction of the continuons motion, which entails a vast saving of labour, as well as wear of the knife, and of the leads against which it cuts.

On the introduction of the continuous motion, the range of the diagonal movement was from one inch and a half to three inches; but such a short slicing cut, although superior to the vertical, was quite insufficient for the hard work to which the machines were subjected.

The first machines on this plan were made with a five-inch diagonal motion, bnt, from experience, we have come to the conclusion that the knife should traverse diagonally, from left to right, at least nine inches in the perpendicular descent of five or six inches.

The great pecnliarity of this machine is, that the under work of it stands at right angles to that of all other machines, and there is a strong spur-wheel with a crank off its centre, to which is attached an oscillating beam, which passes through each side of the upright frames. The upper beam, or knife-holder, requires the most minute accuracy in fitting, and it slides in the upper parts of the frames, in which adjusting steel bars and screws are fitted.

Each end of the knife-beam has a long connecting rod, and at same time a shorter link or rod, to give the sliding motion, and to keep the knife perfectly parallel with the lead resistance; the two first, or long



rods, are connected with the knife-beam and the under or oscillating beam. One of these rods is divided, and screwed with right and left hand threads, which are connected hy a brass coupling box, to adjust the knife to its required position; this beam is brought down by the spur-wheel gear and fly-wheel, to which the handle of the machine is attached. There is also another adjustment in the bracket, at the left hand parallel liuk, to regulate a knife which may be broader at one end than the other, which is found to be of very important practical use.

THE EDINBURGH TIME-GUN.

The electrically-fired time-gun on the ramparts of Edinburgh Castle has been found of immense service in and about Edinburgh, in keeping the clocks and watches of the district within reasonable bounds as to the measurement aud indication of time; and it is interesting to notice that its value is felt and appreciated over a much more extended area than was at first supposed.

Mr Daniel Campbell, the forester at Wemyss Castle, in Fifeshire, on the other side of the wide Frith of Forth, has made careful observations as to the reports of the gun, showing that others than the Edinburgh citizens profit greatly by the gun. The following is the result of his observations, as extending over a period of nearly three weeks:—

A misty day, and heavy showers of rain. Wind south-west. A dull report, but quite audible.
A dull but fair day. Wind south-west. A loud report.
High wind from south-west, and heavy rain. A very loud report.
In the castle office, with door shut, wind high from south-west, and heavy rain. Gun well heard.
At Perth, gun not audible.
Wind south-west; day fair. A muffled sound.
A fair day; south-west wind. Gun heard.
South-west wind; fair day. No report heard.
North wind; frosty. A low report.
North wind; frosty. A loud report.
Frosty. An extra loud report.
A frosty day. A loud report.
A frosty day, and very misty. Gun not audible.
Frosty. A double report heard.
A fresh and mild day; north-north-east wind; very misty. An extra loud report.
Frosty. A very loud report.

The observations were taken chiefly at Wemyss Castle Plantatious, which are sixteen miles from Edinburgh. The report of the gun is heard there just sixty seconds after the discharge. It is also heard at Markinch—twenty-one miles from Edinburgh; and it is believed that every clock, and watch, and bell in the district is regulated by it. As it appears, from the foregoing statemeut, that the gun can be distinctly

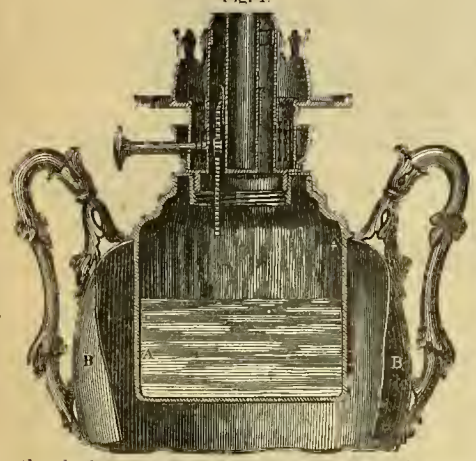
heard within a distance of about twenty miles, and as it is of incalculable benefit to all within hearing of its report, might not other towns, especially in populous districts, follow the example set by Edinburgh, and have time-guns placed throughout Scotland, at a distance of about twenty miles from each other, for the benefit of the inhabitants. The expense might be defrayed by the magistrates, railway companies, and proprietors of public works in the several districts.

RECENT PATENTS.

PARAFFIN LAMP.

PETER SHAW, *Edinburgh.—Patent dated February* 7, 1862.

Fig. 1.



THESE letters patent specify new and improved lamps for burning paraffin oil and some other fluids. The vessel to contain the oil is generally made of a bad conductor of heat, such as glass, to prevent the oil being heated by the burning of the lamp; this circumscribes to a certain extent the form and decoration of the lamp; in consequence of this, one part of these improvements consist in constructing lamps having the vessel to hold the oil made of glass or other bad conductor of heat, and place this vessel wholly or partially within an outer covering of the form and material required to suit the design of the artist, and when a metallic tube or rod passes through or into the oil vessel, it is preferred to cover such tube or rod with a bad conductor of heat to prevent its contact with the oil.

Fig. 2.

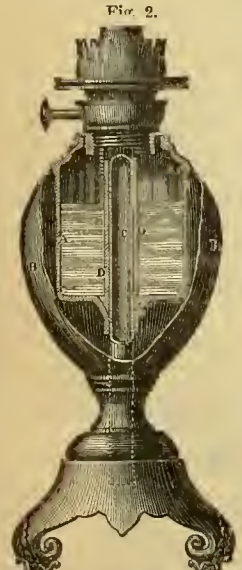


Fig. 1 of the accompanying engravings is a vertical section of the upper portion of a lamp constructed according to this invention. A, is the vessel for containing the oil, made of some bad conductor of heat, such as glass or stoneware, it is inserted in and secured to an external vase or holder, B.

Fig. 2 is an elevation partially in section of a lamp, in which an air tube passing through the oil vessel is employed. C, is the air tube, and, D, is a ferrule or tube of glass or other bad conductor of heat, extending round that portion of the tube, C, which passes through the vessel, A. The ferrule, D, is fixed to the tube, C, by cement.

The two principal features of this invention being—

First, the constructing lamps for burning paraffin oil and some other fluids, with a vessel for containing the oil, made of glass or other bad conductor of heat, surrounded with a vase or holder capable of being ornamented with any desired design, or of being made of any required shape; and second, the surrounding the air tube or rod which passes through the oil vessel with a ferrule or tube of glass or some other bad conductor of heat, all as hereinbefore described.

MUSICAL INSTRUMENTS.

GEORGE CRAWFORD, *London.—Patent dated May*, 1862.

THE specification of these letters patent relate more particularly to a peculiar construction of musical instruments, capable of being played upon by means of keys similar to a pianoforte, and also to the "actions" or mechanical mechanism employed in striking and producing the notes in such instruments. The principal feature in this instrument consists in substituting for the strings hitherto used in pianofortes a number of metal prongs or "vibrators," somewhat similar to those used in musical boxes, or similar to the musical pitchfork, properly tuned and acted upon either by jacks, as in the harpsichord, or by hammers brought into play by a percussion action on the keys.

Another part of this invention relates to an improved action, which is applicable to pianofortes as well as to the improved instrument just referred to, whereby greater nicety of touch, with increased power of blow and effective check action, at a reduced expense, is obtained. These improvements consist in making the butts of the hammers bevelled, or curved inwardly on their under surfaces, and in causing the fly to act directly upon such butt, thereby dispensing with the use of stickers and levers. The bevel curve forms also an efficient check to the fly, preventing it from being thrown too far forward. One portion of these bevels may be made adjustable, so as to regulate the check action.

Fig. 1.

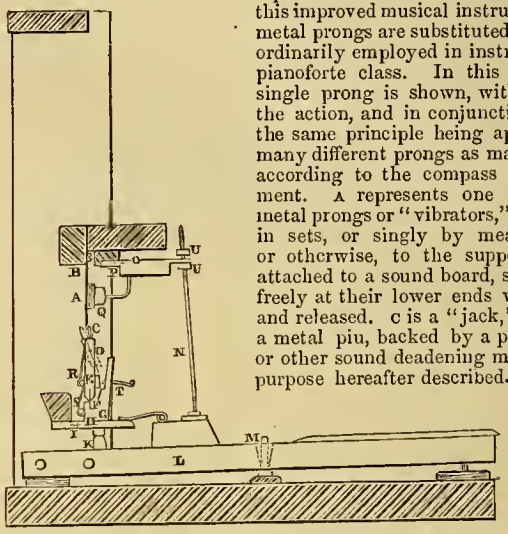


Fig. 1 of the accompanying engravings represents a side elevation of a portion of this improved musical instrument, wherein metal prongs are substituted for the strings ordinarily employed in instruments of the pianoforte class. In this figure only a single prong is shown, with one form of the action, and in conjunction therewith; the same principle being applicable to as many different prongs as may be required, according to the compass of the instrument. A represents one of a series of metal prongs or "vibrators," firmly secured in sets, or singly by means of screws or otherwise, to the supporting bar, B, attached to a sound board, so as to vibrate freely at their lower ends when deflected and released. C is a "jack," consisting of a metal piu, backed by a piece of leather or other sound deadening material, for the purpose hereafter described. This pin, C, is screwed, so as to be readily adjusted in height by turning the same, into the small hinged piece, D, connected by a joint pin to the lever, E, which is hinged at F, to the part, G, of the horizontal lever, H, working on a hinge at I. The under side of the lever, H, is acted upon by a stud, K, on the top of the inner end of the key, L, which is centred at M, in the usual manner adopted for pianoforte keys, the key-board of this instrument being precisely similar to that of a pianoforte. N is the rod for working the damper, O, which is jointed on a hinge at P, and is provided with a pad, *a*, which bears upon the prong or vibrator after the release of the key, but is drawn off by the depression of the key. In striking a key the lever, H, is elevated, and the pin or jack, C, moved forward so as to catch the end of the prong or vibrator, A, deflect the same, and then slip off or release it, allowing it to vibrate and give forth its sound. When the key is released, or allowed to rise again, the lever, H, descends, and the pin or jack, C, returns to its original position in front of the prong or vibrator. This return of the pin or jack, C, is allowed for by reason of the hinged piece, D, which turns over slightly as the pin, C, comes against the back of the prong in its return, and so permits it to pass the prong without interruption or check, the spring, R, serving to bring the piece, D, to its normal position again. T is a regulating pin for adjusting the distance between the pin or "jack," C, and the prongs, A and U, are the adjustments for the damper, O. Any jarring between the pin or "jack," C, and the prong or vibrator, when the jack comes in contact with it at its return movement, is prevented by the backing of leather on the pin, before referred to.

Fig. 2.

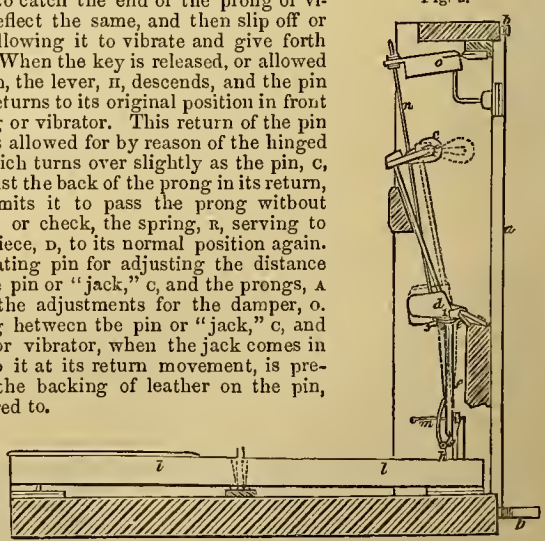


Fig. 2 represents an improved and simplified pianoforte action, as arranged and constructed in accordance with this invention, and which is

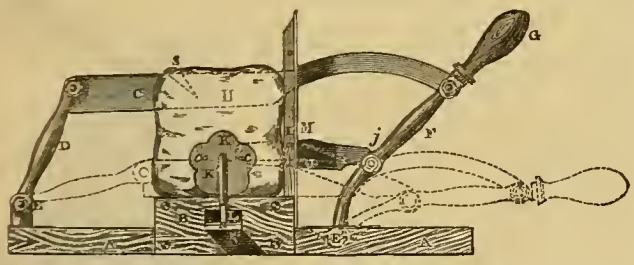
also applicable to the improved instrument before described. *a* is the striug of an upright piano, secured in the usual manner at *b*; *c* is the hammer, *d* the improved hammer butt, (shewn half size in fig. 3), which is bevelled or curved inwardly at *e*, and suitably covered with leather to prevent noise. The upper eud of the fly, *f*, bears against the raised portion, 1, of the butt, *d*, when striking the hammer forward, and throws off at the proper time by slipping into the recessed portion or notch, at 2. The check action is obtained by the projection or straight side of the recess or notch, at 3, coming against the end of the fly, as shown in the dotted lines which represent the hammer thrown off from the string. This part may consist simply of a piece of felt glued to the butt, as shown in fig. 3, or it may be made adjustable, so as to admit of the check action beiug regulated. The lower end of the fly is hinged, at *g*, to the separate piece, *h*, let into the key, *l*, aud is provided with a regulating screw, *m*. In some cases, if found desirable, a small spring is attaehed to the under side of the hammer butt, at the part corresponding to the raised portion, 1, so that the fly will strike against this spring, and through it give the necessary impetus to the hammer. By the use of this spring a better repeat action, and greater elasticity of touch, will be obtained. *o* is the ordinary damper, which is worked by a rod, *n*, conuected with the butt of the hammer.

Fig. 3.

BREAD CUTTING MACHINE.

John Oxley, *Sheffield.—Patent dated April* 30, 1862.

These letters patent specify a new and improved arrangement of apparatus for cutting, slicing, or chopping either bread, cheese, suet, vegetables, tobacco, leather, paper, or other substances of a like nature, and consists essentially in the employment of a long knife, which is connected at each end to a lever, and arranged so as to traverse longitudinally and vertically by the vibration of these levers, having their fixed centre on the table or base of the apparatus, thus imparting a draw cut to the knife in a downward direction as the levers vibrate. These levers may be of the same or different lengths, respectively, and may be worked either by hand or by the foot, as preferred. The material to be cut is placed on a table or platter, which may be made to travel under the knife after each cut, or the table may remain stationary, and the material traversed along it by means of a spring, or by any self-acting contrivance actuated by the knife mechanism. A suitable gauge is attached to the front lever of the knife for the purpose of regulating the thickness of cut, or the forward feed of the substance. In some cases the table or platter may be made to rotate, as, for example, where it is used for chopping or mincing substances.



The accompanying engraving is a side elevation of one form of this improved cutting or slicing apparatus.

The base or sole, A, of the machine is formed of hard wood, of a rectangular shape, in the centre of which the cutting table, B, is placed, for the reception of the loaf of bread or other substance intended to be cut on it. The knife, C, which consists of a thin deep blade of steel, is jointed at its rear end to a lever or link, D, the lower extremity of which is centred at E, upon a pivot or centre pin fixed to the base, A. The front end of the knife, which is formed into a segmental link, is jointed to a second lever or link, F, working on a centre, E¹, also fixed in the base, A, and is provided with an actuating handle, G. When used as a bread slicer, a loaf, H, is placed upon the table, B, being supported against the upright I, and pressed forward against a gauge, J, by means of a feed plate, K, acted upon by a spring or springs at L, contained inside the table, B. The gauge, J, consists of an arm hiuged at *j*, to the link or lever, F, its forward end working to and fro through a slot or opening at M, in the upright I. Against this gauge the front end of the loaf is pressed by the spring and feed plate hereinbefore referred to. The distance between the gauge and the knife is always equal to the thickness of the slice cut off, and this distance is regulated to suit any desired thickness of slice hy making a screw thread on the pin, *j*, which connects the gauge with the link, F, and forming a corresponding internal screw in the base of the gauge arm, so that by turning the screwed pin, *j*, the gauge may be moved nearer to or further from the blade, the pin being held in a bearing at each end of the bracket. The upright I, made of metal or wood, has a vertical guiding slit made in it for the knife to work through, and to prevent this slit from being worn, if made of wood, it may be faced on one side with a slotted metal plate, screwed to the upright itself. The feed plate, K, is formed in one piece, with a handle, K¹, for the facility of drawing it back, and is screwed to a metal plate, N, sliding in a groove inside the table, the top of which table is removable. A hinged catch is attached to the sliding plate, N, capable of having its front end depressed, when the slide is drawn out, for the purpose of retaining it, by abutting against the edge of the table, or against a piece of metal for that purpose screwed thereto. In order to allow of a long traverse of the slide with comparatively slight extension of the helical springs at L, and to compensate for their variable power at different degrees of extension, it is proposed to connect these springs by means of a cord or gut, with a fuzee and barrel. The cord from the springs passes round the fuzee, wilst the other cord, which is attached directly to the slide, N, is wound round the barrel, the fuzee and barrel being both fast on the same axis. A loaf having been placed on the table, B, and forced against the spikes, *c*, in the feed plate, K, the latter is released by raising the front end of the catch before described for holding it, the loaf will then he forced against the gauge, J, the latter being pushed forward by reason of the elevated position of the knife. By depressing the handle, G, the knife is simultaneously depressed and drawn forward, thus making a downward and a forward or draw cut, and severing a slice from the end of the loaf. The slice so cut is separated or pushed from the end of the loaf by means of an inclined piece or ridge, s, shown in dotted lines as attached to the blade of the knife. As the knife deseends the gauge is drawn back clear of the loaf, and when it is raised again for the real cut, the gauge advances in readiness for the real cut, and the loaf is pressed against it by the action of the springs, as hereinbefore described. In some cases, if desired, the gauge may be dispensed with, as well as the self-acting feeding mechanism, the loaf being fed forward by the hand of the operator, so as to cut any thickness of slice required.

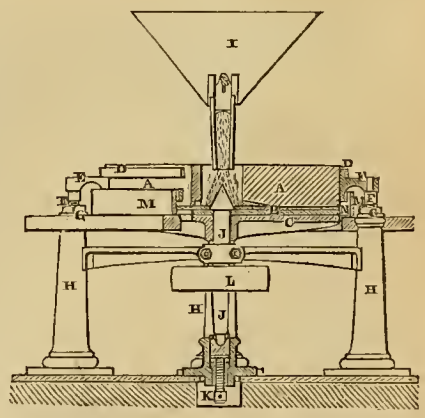
Another slightly modified form of apparatus is also specified, in which the back lever or link, D, is replaced by an inclined slotted bracket or arm, fixed to the base or side of the table. In the slot of this bracket or arm slides a pin, passed through the end of the knife, so that as the blade is depressed and drawn forward to make a cut by the action of the handle, O, its rear end will slide down the guiding slot and produce the draw cut desired. The front end of the knife is attached, as before described, to a link or lever, F, but the fulcrum of this link is brought nearer the front of the base plate. The tension of the feeding springs in this arrangement is regulated by a stationary screw and a nut travelling along it, which nut forms the attachment for the spring or springs.

RICE CLEANING MACHINE.

J. H. Johnson, *London and Glasgow,* (Wellington Lee *of New York, U.S. of America).—Patent dated November* 25, 1861.

This invention relates to a peculiar construction and arrangement of machinery or apparatus intended more especially for shelling or hulling and cleaniug rice, although applicable to the treatment of wheat and other grain.

Fig. 1.



Accordiug to this invention, it is proposed to employ two horizontal surfaces, one of which surfaces is made to rotate in close proximity to the other, whilst the other surface is held stationary; the rotating surface is intended to be covered with india-rubber, gutta percha, or other equivalent material, and the stationary surface is composed of stone; provisiou is made for adjusting the distance between these two surfaces, so as to suit the grains of different sizes. The grain to he treated may be introduced between the rubbing surfaces from above through an aperture in the upper rubbing surface.

Fig. 1 of the accompanying engravings is a vertical section of the improved machine for shelling and cleaning rice or other grain, constructed according to this invention; and fig. 2 represents a portion of the stone and india-rubber disc beneath it in vertical section to a larger scale than in fig. 1. Fig. 3 is a plan of the under side of the stone, on a smaller scale than in fig. 1, showing the grooves or channels therein, hereafter referred to; and fig. 5 is a plan of the upper surface of the india-rubber, or other equivalent covering of the horizontal disc, showing the different modes of roughing or grooving its surface when desired.

Fig. 2.

The stone, A, which is stationary, is placed horizontally, and may be similar to an ordinary millstone for grinding corn; beneath it is placed a covering or sheet of vulcanized india-rubber, B, secured to the surface of a horizontal disc, C, of wood, metal, or other suitable material, as a foundation. The stone, A, is enclosed in a metallic ring, or rings, D, from which rings project four arms, E, having eyes at their outer ends, which fit on to studs formed on the upper ends of the four elevating or adjusting screws, F, and rest upon the large nuts, G, of those screws. These screws, F, work through their corresponding fixed nuts in the top of the cast-iron columns or supports, H, and the studs at the top of the screws, F, turning freely in the ends of the supporting arms, E, so as to admit of the rotation of the screws when levelling or adjusting the position of the stone, the screws being provided with suitable heads for that purpose. If preferred, the screws may be elevated without rotating them, by making their nuts, G, so as to turn in the tops of the columns, H. In this case, the screws, F, may be formed with forks at their upper ends, into which the arms, E, rest. The rice or other grain to be operated upon is fed into the eye of the stone from the shoot leading from the hopper, I, such hopper being provided with the usual sliding door for the regulation of the feed. The horizontal disc, C, with its covering of vulcanized india-rubber, B, is secured by keying or otherwise to the upper end of the vertical shaft, J, which works in a collar and footstep bearing. The collar bearing is formed in a transverse bar or bracket bolted at its opposite ends to the diametrically opposite columns, H, and the footstep bearing is made adjustable vertically by means of the screw, K, for the purpose of regulating the height of the disc, C, or its proximity to the under surface of the stone, A. The stone remains stationary, but the disc is rotated by means of a driving pulley, L, keyed on to the shaft, J, or by other suitable gearing. The casing, M, composed either of wire gauze or of a perforated or non-perforated sheet of metal, is made to enclose or surround the edges or peripheries of the stone and rotating disc, a convenient annular space being left all round between the stone and disc and the inner surface of the casing for the collection of the cleaned rice or grain, which is removed by the action of a scraper, N, fitted to the edge of the rotating disc, C, and travelling over the surface of the table inside the casing, where one or more openings are left in the table for the rice or grain to fall through.

Fig. 3.

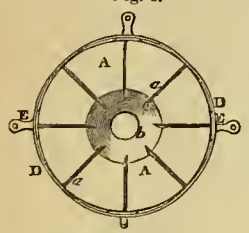
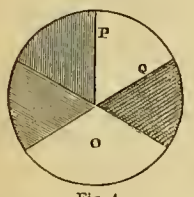


Fig. 4.



It is preferred to make this ring or plate of wire gauze, or of perforated metal, as the interstices afford free escape for the meal or dust from the grain. A cone having its apex upwards is secured to the centre of the disc, C, or is formed on the top end of the shaft, J, so as to protrude through the covering, B, and enter some distance inside the eye of the stone, A. The object of this cone is to disperse or throw off the grain outwards underneath the stone, and prevent any tendency of the grain to settle or lodge on the centre of the revolving disc. By this means the feed is greatly facilitated, and rendered more regular. In order to keep the stone and india-rubber, or other equivalent covering, as cool as possible, it is proposed to direct a blast of air between the rubbing surfaces, and to facilitate the passage of the air, a series of channels or grooves, *a*, shewn in the vertical sectional detail on an enlarged scale in fig. 2, and in the plan of the under side of the stone in fig. 3, such grooves extending from the periphery of the stone to the bevelled portion, *b*, of the eye or bosom of the stone. These grooves or channels should be of a wedge form in transverse section, as seen in fig. 2, the base of the wedge or the deepest part of the channel being on the side opposite to the direction of motion of the rubber, as shown by the arrow in fig. 2. It has been found, that if the india rubber surface, B, be roughened, it will hold the rice or grain longer against the stone than when it is left smooth, and is, therefore, more efficient, although a smooth surface will answer moderately well. Fig. 4 represents different modes of roughing or grooving the surface of the india-rubber, gutta percha, or other suitable disc; O, represents a smooth surface; P, shows a series of grooves running parallel to a radius, and Q, shows other series of grooves or scoring, any one of which surfaces may be adopted if preferred.

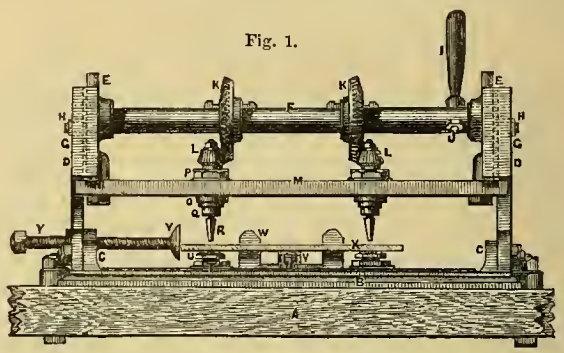
SLATE BORING MACHINE.

ALEX. WEBSTER, *Arbroath.—Patent dated June* 23, 1862.

THE improvements specified in these letters, relate to the arrangement and construction of machinery for boring slate, more particularly in the form used for roofing purposes, so that each slate may be perforated at one or more places at a single operation, the perforations being much improved in form from those produced by the usual mode, and suited to receive countersunk headed nails, whilst the loss from breakage of slates in boring is greatly reduced or wholly avoided. The invention consists primarily in applying a combined punching and drilling movement to the tools operating upon the slate, and in shaping these tools and their matrices so as to produce countersunk shaped holes; and also in certain arrangements of parts and mechanism for producing the necessary compound movement of the tools from a simple and intermittent hand action.

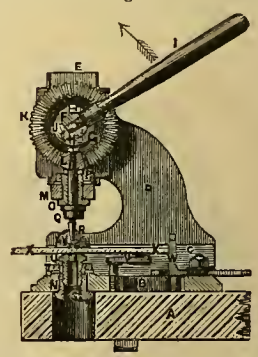
Fig. 1 of the accompanying engravings is a front elevation of one modification of the improved machine for boring roofing slates, and

Fig. 1.



other generally similar articles. Fig. 2 is a transverse vertical section at right angles to fig. 1. As arranged in the present instance, the machine is fixed to a suitable bench or framing of wood, A, to which the bed-plate, B, is secured by bolts and nuts. This bed-plate, or base of the machine, B, is of rectangular figure, formed with two end flanges or vertical feathers, C, to each of which is bolted an end standard or check plate, D. These standards are curved inwards at the lower part of the front edges, and at the back sweep upwards, and form an overhanging head or slide stock to each. A vertical groove of a dovetail figure is formed in the inner face of each head of the standards, D, and in these grooves are fitted the two sliding blocks, E. Each of these sliding pieces, E, has formed on its inner face a laterally projecting boss to receive the end portions or journals of the horizontal shaft, F. The bosses merely form sockets or journals for the concentric revolution for the shaft, F. The bearings or bushes carrying the shaft and forming its fulcrum for the eccentric lever action are each arranged in a horizontal slot, G, formed in the end standards, D; this slot is made sufficiently wide to admit of the bearing bush traversing to a certain extent in a lateral direction. The ends of the shaft, F, are each turned down to form a short pin, H, which is eccentric to the axis of the shaft, and forms a short crank at each end. These crank pins are carried in the bearing bushes which are arranged in the horizontal slots, G, and when a partially rotatory motion is imparted to the shaft, F, it causes the bearings to traverse from one end of the slots to the other. Motion is imparted to the shaft, F, by means of the hand lever, I, the small end of which passes through a hole in the shaft and is secured thereto by a nut, J. The shaft, F, has keyed upon it two or other convenient number of bevel wheels, K, which are in gear with the bevel pinions, L, below them. To the sliding blocks, E, is secured, by means of bolts which screw into bosses formed on the blocks, the transverse rail, M, which is formed with a longitudinal slot in it, extending nearly the whole length of the rail, as shown in the section fig. 2. In this slot are fitted the

Fig. 2.



moveable bushes, O, which are fixed at any distance apart in the leugth of the rail by means of the nuts, P. The hushes, O, receive the spindles, Q, which turn freely therein; on the upper end of each of these spindles is fitted the bevel pinion, L, which is secured by a nut screwed on to the upper end of the spindle. The lower part of each spindle has au aperture in it to receive the drilling punch, R, which is formed of steel, and is of a square figure, tapering towards the point. With this arrangement, when the hand lever, I, is turued in the direction of the arrow, shown in fig. 2, by the hand of the operator, the rotatory movement of the shaft, F, causes the wheels, K, to put the pinions, L, into rapid motion, which is communicated to the drilling punches, R. Simultaneous with this movement is combined the secondary motion of the shaft, F, namely that which is due to the eccentricity of its points of support. Thus when the shaft, F, is turned partly round, the crank pins, H, cause the bearings to traverse along the slots, G, so as to bring the upper surface of the shaft down to the lowest position, and having the handle then projecting out in front making half a turn of the shaft in its concentric and eccentric hearings, which causes a corresponding descent of the drilling punches, R, equal to twice the depth of the cranks; the shaft, F, in the last position, being all below the fulcrums, H, and bushes, G, when the slate is puuched, or in the opposite position to that shown in the fig. This compouud movement thus provides a very efficient mode of perforating slate, or other generally similar materials, the tools having a rapid rotatory as well as descendiug motion imparted to them by the mechanical arrangement of the shaft, F, and the sliding bearings, E and G. The sole plate, B, of the machinc is made with a longitudinal slot, N, in it, similar to that in the rail, M. In this slot are fitted the adjustable tubular bushes, S, which slide to and fro in the slot, and are secured in any desired position by the nuts, T. In each bush is fitted a steel holster piece, U, which is made tubular, and may be adjusted in height by screwing it more or less iu the receiving bush, S. The slate, X, to he perforated rests upon these bolster pieces, U, and upon a third point of support formed by the rest, V, which is screwed at the lower part to admit of being adjusted as regards height. At the back part of the machiue is an adjustable gauge, W, which works to and fro in a slot, and is secured by a tightening nut. The two end pieces of this gauge extend upwards, faciug the front part of the machine, and agaiust these the edge of the slate, X, is pushed, and regulates the distance from the frout at which the holes are to be made. There is also a second gauge, Y, which extends through the left-hand end standard, D, and by screwing this inwards, more or less, the distance of the holes from the side edge of the slate is regulated. With this arrangement, by the simple drawing forward or turning the hand lever, I, for half a revolution, a rapid rotatory and punching motion is given to the combined punching and drilling tools, R, which form neat round holes in the slates, the holes widening out towards the lower side of the slate, as placed in the machine, thus forming a neat counter-sink for the reception of the nail head, by which the slates are secured to the roofing. As the drills, R, descend, their rotation of the four cutting edges, to widen out the holes to the size required, whilst the dislodged material passes through the hollow holsters, U, and hush, S, to the ground. The handle, I, is then returned to the position shown in the figures, and the slate, X, removed in readiness for replacing and piercing another slate. This machiue also effects a considerable saving of time, labour, and economy, as the perforations are made with rapidity and accuracy, and without the amount of breakage that attends the ordinary mode of preparation.

APPARATUS FOR PRODUCING COLOURS.

HENRY DEACON, *Appleton.—Patent dated May* 14, 1862.

THE present invention relates to the manufacture or production of certain colours which are produced, as is well understood, by the action of an elevated temperature on well-known mixtures of clays (*i.e.*, substances consisting mainly of silica and alumina) of sulphate of carbonate of soda, or of both; of sulphur and of carbon or of carbonaceous matter —the free access of atmospheric air during the first heating process being prevented.

In the ordinary process of manufacture, mixtures of these materials are subjected to the primary heating process in closed receptacles, to which access, during the process of heating, is extremely difficult, if not impossible. The first part of these improvements consist in subjecting such raw materials or mixtures to the primary heating process in retorts or ovens, or in other suitable vessels, provided with doors or openings easily removed, but closed air tight, or as nearly so as practicable so that when required, the materials under treatment may thereby be easily inspected, stirred, or otherwise manipulated during such heating operation.

The second part of this invention consists in washing the colours obtained from the processes, hereinbefore described, in what are known as circulating vats or tanks, whereby pure water is employed to complete the washing, whilst all the liquors obtained are highly charged with soluble salts, which are easily recovered for use by evaporating the water holding them in solution.

The retorts or ovens in which it is preferred to effect the primary heating are so constructed that all contact of flame, with the materials operated upon, is prevented, and (except as to the doors and outlet for the gases evolved during the process,) are similar to those known as the "close" or "blind furnaces" employed in the manufacture of alkali for roasting salt cake, or sulphate of soda. The doors of these latter furnaces are, however, rarely capable of closing so perfectly as is uccessary for the manufacture of the said colours. It is preferred to have the face of the iron frames and doors planed so that the doors will slide on the frames; the planed surfaces being in close contact. Each door is provided with a screw clamp, similar to those used with gas retorts, for forcing the door into its place when required. The fasteuing and other apparatus for these clamps must uot, however, interfere with the easy opening or closing of the doors. Through these doors the material may be introduced and withdrawn, inspected, stirred, or otherwise manipulated. Other and much smaller doors may be employed for these latter purposes, and the large doors used only for the introduction and withdrawal of the materials. The doors may be all on one side of the furnace, or otherwise disposed as desired. The gases evolved during the process are, by preference, allowed only to escape from one or more of the doors left open only so far as will suffice for this purpose without admitting any atmospheric air. Any manipulation of the materials under process it is preferred to effect by instruments passed through an opening from which these gases are escaping, as the atmospheric air is thereby excluded. When no gases are given off, all the doors must, during this primary heating, be tightly closed. "Close" or "blind furnaces," above referred to, are, by preference, made of bricks, but other materials and forms (amongst others, ordiuary gas retorts,) may be employed, if provided with suitable easily moved, but tightly closing doors. In the ordinary "close" or "blind" brick furnace, the flame usually passes through a flue or flues over the arch or roof down the end under the bed or bottom into the chimney or bye flue. This arrangement is the most durable, but, if preferred, the course of the flame may be varied in many ways. As in the ordinary construction of brick, "blind," or "close furnaces," no flame passes down the sides, it is, in such cases, better to keep the arch or roof very near the bed, say 6 or 9 inches from the bed to the springing of the arch, and the latter kept as flat as is consistent with stability.

The vats or tanks employed for washing the said colours are constructed on the same principle as the "black ash" vats or tanks employed in the manufacture of alkali. The circulation of the wash water may be effected or assisted by pumping, and the water may be either hot or cold. The false bottoms may be made of filtering cloth. The said colours being usually very finely divided, a bed of a few inches only in thickness is commonly desirable, as the resistance to the free passage of the water is considerable; and for this reason care must be taken to make the vats so deep as will give sufficient head of water to ensure the necessary circulation.

Figs. 1 and 2 of the subjoined engravings represent respectively vertical and horizontal longitudinal sections of a blind or close furnace,

Fig. 1

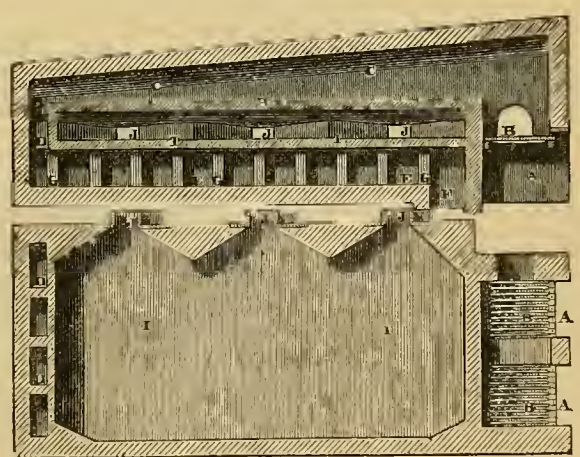
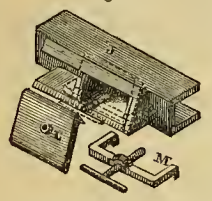


Fig 2.

retort or oven, provided with doors, and without other outlet for the gases evolved from the materials under process, in accordance with this invention; and fig. 3 is an isometrical view to double the scale of

figs. 1 and 2, of the details of the door-frame, door, and clamp of the furnace. A, is the ash-pit; B, the fire-place; C, the flue over the top arch, H, of the furnace or retort; D, the descending flue at the end. E, is the flue under the bed, I, which is supported by the pillars, G; the flame finally escapes to the chimney by the flue, F. The door-frames are shown at J; the door at L; and the clamps, for fixing the latter, at M. The doors, L, are so made as to slide on, or be lifted off the door-frame, J, as may be found requisite when the clamp, M, is removed. The doors and frames may be of cast iron, and the clamp of wrought iron. A damper may be inserted at any convenient position in the flue, F.

Fig. 3.



The circulating vats are shown in elevation and plan at figs. 4 and 5 respectively. T, T_1, T^2, T^3, are the vats; T^3 being shown in section in fig. 4; U, the false bottoms, and, V, are the pumps or upright circulating pipes opening under the false bottoms, of one vat, and by a side branch communicating with the body of the next vat. They are open at the top for the introduction of a "bucket," when the circulation is assisted by pumping;

Fig. 4.

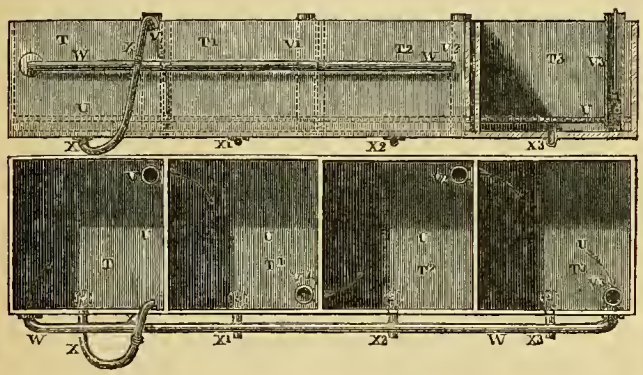


Fig. 5.

in which case a foot valve, is, of course, also necessary, as shown in the section. When the gravitation of the washing water is the only power used to effect the circulation, the pipes have no valves or buckets but *v*; below each side branch pipe there is a contraction into which a plug is inserted, through the open top, whenever one vat is to be isolated for emptying. W is the horizontal circulating pipe for connecting the under side of the false bottom of one end vat with the body of the other end vat. X, X^1, X^2, X^3, are pipes for running off the liquor from the vats. In place of putting taps or cocks to these pipes, it is found convenient to attach to them pieces of flexible tube, provided at the other end with a tube bent in the form of a hook. When hung on the top edges of the vats, as shown, no liquor can escape; but, when lowered to any required level, the liquor can be run off to that level into any convenient vessel. To avoid confusion in the illustration, only one flexible tube, etc., is shown; but one is, of course, in practice, attached to each pipe, X. The arrows show the course taken by the water. It is rarely sent a complete circle; but the material to be washed being spread on the false bottoms, the hot or cold water, as the case may be, is run over one of the vats, say T, it filters through the material, passes under the false bottom, up the pipe or pump, V, into the vat, T^1, and similarly through each vat and pipe, until it arrives at T^3; the liquor, in filtering through each bed of material, extracting some of its soluble salts, etc., and becoming more highly charged therewith. From T^3, the liquor is run off by the pipe X^3. When sufficient water has been run into T, the supply is stopped, and all is pumped from under its false bottom into the vat, T^1. T is then emptied of washed material, and a fresh supply put on its false bottom. The pure or fresh water is then run into T^1, and the liquor, on reaching X^3, runs from it by the pipe, W, into T, which thus becomes the last of the series, and the strong liquor is run from its pipe, X, and so on, each vat becoming in turn the 1st, 2d, 3d, and 4th in the series, without the material under process being removed.

LAW REPORTS.

ANILINE DYES: SIMPSON, MAULE & NICHOLSON (MEDLOCK'S PATENT) *v.* WILSON *et al*—INFRINGEMENT.—This was an action in the Court of Queen's Bench, before the Lord Chief Justice Cockburn, by the assignees of a patent, sealed on the 13th of July, 1860, and granted to Mr Henry Medlock, analytical chemist, of Great Marlborough Street, for improvements in the preparation of red and purple dyes. Sir F. Kelly, Mr Grove, Q.C., Mr Bovill, Q.C., Mr Drewry (of the Chancery bar), and Mr J. A. Russell, were for the plaintiffs; Mr Hindmarch, Q.C., and Mr John C. F. S. Day, were for the defendants. The plaintiffs, Messrs Simpson, Maule, & Nicholson, are the well-known manufacturing chemists, carrying on their business in the Atlas Works, Newington-Butts, and they sued Messrs Wilson & Co., also manufacturing chemists, in Jubilee Street, Mile-End, for an infringement of the patent above mentioned, which has acquired considerable value by means of its producing the fashionable Magenta red and purple colours. It appears that Mr Edward Chambers Nicholson, one of the plaintiffs, discovered, after many experiments, that these beautiful dyes could be produced by a combination of aniline (a substance extracted from coal tar) and arsenic acid, but he also found, on provisionally registering his invention, that the same discovery had been made by Mr Medlock, and patented some short time previously. Under these circumstances, he and his partners purchased Medlock's patent for £2000, and the claim under that patent was for the manufacture or preparation of red and purple dyes by treating aniline with arsenic acid, as described in the specification, which was in these terms:—

"I mix aniline with dry arsenic acid, and allow the mixture to stand for some time; or I accelerate the operation by heating it to or near to its boiling point, until it assumes a rich purple colour, and I then mix it with boiling water, and allow the mixture to cool. When cold, it is filtered or decanted. The aqueous solution which passes through the filter contains a red colouring matter or dye, while a tarry substance remains in the filter. This tarry substance, dissolved in alcohol, methylated spirit, or other suitable spirit, furnishes a purple dye. These solutions of colouring matter may be used at once in the process of dyeing, concentrated or diluted, according to the tints required. The mixture of aniline and arsenic acid, after being heated, may be allowed to cool, and then forms a paste, which may be preserved. When required for use, it is mixed with boiling water, and treated as above described. I have found that the proportion of two parts by weight of aniline to one part by weight of arsenic acid yields a good result; but I do not confine myself to that proportion, as it admits of variation."

Almost the sole question in dispute was, whether the words "dry arsenic acid," in the first line of Mr Medlock's specification, meant anhydrous arsenic acid, or whether they meant arsenic acid not wet or moist, but having in its constitution certain atoms of water. It was clear that anhydrous arsenic acid, or the acid freed from all atoms of moisture by exposure to heat, would not produce the effect desired when mixed with the aniline, and it was also clear that until the acid possessed as many particles of water as are contained in the constitution of what is popularly termed dry arsenic acid, the effects could not be produced. The evidence was extremely conflicting as to the proper meaning in chemistry of the word "dry," some scientific witnesses stating that it implied the removal of all water in combination, as well as any accidentally present, in which case the specification would be bad; and other scientific men asserting that it meant simply not in a wet or moist state, in which case Mr Medlock would have accurately described the necessary ingredients in his process. The defendants relied upon another point—viz., that the term "dry" was ambiguous, and that the specification was, therefore, bad. The process of the defendants was to use the arsenic acid in solution when treating it with the aniline, and they contended that as dry arsenic acid was specified in Medlock's patent, their process was not an infringement. But the plaintiffs' counsel argued that any one, knowing the chemicals to be combined, might easily use one in solution and evaporte the surplus water, until it was practically in the same condition as if it had been used in a dry state, and that therefore no patent would be worth one farthing if it could be thus evaded.

The Lord Chief Justice, in summing up, directed the jury not to scan the specification in a spirit of hostile criticism, seeking to find out objections, but in the spirit of men desirous of understanding its meaning, and of using the knowledge which it contained. As to the question of infringement, if they were satisfied that the two processes used by the plaintiffs and defendants were substantially the same, their verdict would be for the plaintiffs, although it might have the curious result of giving to Mr Medlock's patent a wider scope than the inventor himself intended, because it was Mr Medlock's intention to caution the world to use the arsenic acid in a dry and undissolved state, and it was now found that it could be used in solution.

A juror asked what their verdict ought to be if they were of opinion that the present process, though substantially the same, was an improvement.

The Lord Chief Justice said that no one, by superadding something, could deprive a patentee of his rights. The improvement might be the subject of a separate patent, but the discovery of the improvement would not give any right to use the substantial process without the licence of the original patentee.

The jury, having been locked up nearly two hours, and being unable to agree, were discharged without giving any verdict.

Organs: Willis *v.* Davison—Infringement.—This was an action in the Court of Queen's Bench, before the Lord Chief Justice Cockburn, and Justices Wightman, Crompton, and Mellor, by an organ builder against another, for an alleged infringement of a patent taken out by the plaintiff in 1851, for an invention exhibited by him at the Great Exhibition in that year, "for improvements in the construction of organs." It is impossible to have any adequate idea of the case (which, on account of the great general use of the organ, and the grandeur of its music, is one of some public interest), without a brief explanation of the general nature and construction of this noble instrument. It is known to every one, that an organ is a wind instrument, though played like a piano, supplied with wind by means of a large bellows. It is not so generally known that in a large organ, like the organ of a church, there are three parts, called the great organ, the "swell" organ (to produce a swell of sound), and the choir organ, to produce softer or gentler sounds, to accompany the voice. To these there is sometimes added a fourth part, a "pedal" organ, for bass notes. All four parts may be seen in such great organs as those of Westminster Abbey, the Temple Church, or Exeter Hall. There are organs in the trade called "general swell" in which the "swell" of sound is sought to be produced within the same "case" as the rest of the instrument. In other and larger organs—made on the newer and later principles—this "swell" is sought to be produced by a separate and distiuct portion called the "swell-box." In this class of iustruments, the "swell" part of the organ and the "swell" of sound—on which so much of the effect of the instrument depends—has been a "swell-box," as it is called, which, prior to the plaiutiff's invention (as he alleged), had heen connected with the larger bellows and supplied with wind therefrom, aud subject to a certain defect, owing to the difficulty of stopping the rush of air, so as to stop the "speaking" of the instrument before a new note was struck. It is still less known, probably, that in addition to the large bellows supplying the whole with wind, there have been, within the last half century, applied systems of small bellows fed from that larger one, and in which the air moved levers—called in tbe more scientific language "pneumatic levers." In popular and plainer terms, these are in effect small pairs of bellows reversed, moving levers put in motion hy the touching of the keys. It can easily be seen from this explanation that the action of these "levers"—and therefore the power of playing the instrument—must depend a good deal on the construction of the "valves" by which they are worked, and the easing of their movements. So much being premised, our readers may now be able, in some degree, to understand the nature of the improvements for which the plaintiff had taken out his patent. In this patent, the objects sought to be attained, were—first, to give a rapid utterance to organ-pipes of large dimensions, and that with a decreased expenditure of muscnlar power on the part of the organist; secondly, to improve the effect of the "swell organ" (the part designed to produce a "swell"), and bring the tone of the pipes in the "swell-box" under more perfect command; thirdly, to steady the action of the bellows' levers, "draw-stops," swell-shutters, composition pedals, and like moving parts, and prevent all unnecessary friction; fourth, to bring the "stops" more thoroughly under the commaud of the performer, so that he can effect a variety of changes by putting in or drawiug out such stops as may be required, without the use of pedals, as heretofore; and without removing his hand from the key-board; and, fifth, to effect a saving of space hy improving the management of some of the internal parts of the organ. It will be seen that the case was one of some musical interest, and it illustrated some general principles of the law of patents. The second head of the invention (which was one of its main points) consisted in placing the bellows which supply the organ with wind in the swell-hox itself, so that the air, as it is expelled from the pipes, is drawu into the hellows and used again. The effect of this novel application of the bellows (as described in the specification) is, that the compression of air in the swell-box when tbe front is closed and the pipes of the swell organ are sounding, and consequently emitting wiud from the external bellows, is entirely prevented, and thus the liability of the pipes to speak out of tune, by reason of the vibration being checked, is avoided, and a more subdued tone is ohtainable. The other great point was to the improvement in what are called the "pneumatic levers" by which the air compressed hy the bellows is made the motive power for working the stop rods; the improvement claimed being the application to pneumatic levers of an improved "escape valve whereby the reiterating power of the pneumatic lever is greatly increased, and the touch of the organ is improved." It was admitted that "pneumatic levers" and escape valves had been used before, but not "compensating valves," so constructed as to admit of a more rapid and easy fingering of the keys. The compensating valves had been used, but not as escape valves, nor in connection with "pneumatic levers." Thus it will be observed that the invention on this point was narrowed to the application of the compensating valve as an escape valve in connexion with pneumatic levers. All that the public generally are concerned in, aud all that can he made clearly intelligible is the alleged practical result or value of the invention, which was thus described:—That "the valve is opened by the rolling of the valve cover, by which means the great resistance offered by the pressure of the wind in the air chamber to the opening of the large valves, hitherto detrimental to developing the capahilities of both the organ-builder and the performer, is counteracted, and thus the huilder is enabled to increase the capacity of the instrument without the fear of its heing beyond the muscular power of the player to bring the various 'stops' into use as they may be required for the efficient performance of any given piece of music." Such being the character of the alleged invention, as claimed and described by the plaintiff, the case was tried before the Lord Chief Justice, at Guildhall, in Decemher, 1861, when the novelty of tbe alleged invention was disputed, and it was first contended on the plaintiff's case, and this being overruled, a body of evidence was called for the defence to disprove the novelty. In the course of the evidence, the organs of several churches were mentioned, as those of St Mark's and St Sepulchre's, London, the Moravian Church at Dublin, and Lee Church, Kent, where it was said the alleged improvements, or some parts of them, had been used prior to the patent of the plaintiff. On the other hand, it appeared from the evidence of Mr Telford, the celebrated organ builder of Dublin, that the plaintiff's improvements had been displayed in an organ exhibited at the Exhibition of 1851 (and now in Winchester Cathedral), and that that eminent builder was then for the first time made aware of them, and introduced them into an organ built by him for Lord Dunraven. As the evidence for the defence did not carry the case further than the above admissions on the part of the plaintiff, it was considered rather to raise a question of law, which was reserved for the Court. A question, however, arosc as to the meaning of the words "swell organ" in the specification, because, unless it was to he understood in the sense contended for by the plaintiff, it was admitted that the second part of his invention could not be novel, though it was iusisted that even if it was so understood the new application was not a subject of a patent. As to this, the plaintiff's case was that it meant a triple organ—that is, an organ having a "swell box," but having also at the side two other organs. This being left to the jury, they found for the plaintiff, and the Lord Chief Justice was of the same opinion. The verdict therefore passed for the plaintiff, subject to the questions of law. Theso questions now came on to he argued on a rule to enter the verdict for the defendant. As the Court found it impossible to understand the mechanical details of the argument without the aid of the models, it is of course hopeles to endeavour to onable our readers to do so, except so far as it turned on any general principle.

Mr Wehster and Mr Barrow were for the plaintiff; Mr Grove, Q. C., Mr Hindmarch, Q. C, and Mr Macrory, were for the defendaut.

The duty developed upon Mr Barrow (who opened the case) to explain, with the aid of drawings and models, the naturc and construction of the orgau and of the plaintiff's alleged improvements, and

The Lord Chief Justice complimented him on the clearness with which he did so.

It may be stated, in general, that it was not disputed that a new combination and application might be the subject of a patent; but the twofold question was whether the combination of the "compensating valves," with the pneumatic levers as escape valves, and the placing of the bellows of the "swell organ" in the "swell box" itself, came within that general principle. The argument on the part of the defendant was that there was merely a new application of an old invention, or, at the utmost, so trifling a change in combination as not to constitute a really new invention. On the other hand, it was argued with great force, on the part of the plaintiff, that though the change might be small, yet the result was great; that it had obviated defects which had long been observed (especially as to the difficulty of so easily checking and controlling the speaking of the instrument as to prevent discord between the notes of the "swell organ" and the other parts of the organ), and that if a result beneficial to the public was produced, the smaller the change the greater the merit. Watt's great steam-engine patent was adverted to as a remarkable instance of prodigious result obtained by a comparatively small means, and the present was put as an analogous illustration of the same great principle. This was the part of the argument which was of most general interest.

Mr Grove, however, argued on the part of the defendant so successfully that

The Court stopped him, being satisfied by him that, as it appeared on the evidence that the pneumatic levers were only another form of bellows, and that the escape valves had been applied to the old form of bellows, the new application of it by the plaintiff was not the subject of a patent.

The Lord Chief Justice, in pronouncing the judgment of the Court,

said he regretted this result, as the plaintiff had certainly introduced a considerable improvement, and which had not occurred to any one before. But the authorities on the subject were too strong to be got over, and therefore there must be judgment for the defendant.

Marine Engines: Spencer *v.* Jack and Another—Infringement.—This was an action in the Court of Queen's Bench, before the Lord Chief Justice Erle and a special jury. It was an action brought on behalf of a consulting engineer of Newcastle-upon-Tyne against the defendants, engine makers of Liverpool, for the infringement of a patent taken out by the plaintiff in 1860 for certain improvements in marine steam engines. The claim of the plaintiff under his patent was two-fold: First, in the arrangement of inverted direct-acting screw engines, a disposition of surface condensers by which the external casting thereof forms part of the main framing, and is placed between and under the cylinders of such engines, and the tubes whereof, being horizontal or slightly inclined, are placed across the line of the keel or propeller shaft; secondly, in the arrangement of paddle-wheel engines, a disposition of surface condensers by which the external casing thereof is placed between the cyliuders, and may or may not form part of the main framing of such engines. The tubes of such condeusers, being horizontal or slightly incliued, are placed across the liue of paddle shaft, and in line with the keel.

The defendants denied the novelty of the invention, but, after a short deliberation, the jury found for the plaintiff as regarded both claims.

Trade Marks: Farina *v.* Zadig—Injunction.—This was a motion in the Vice-Chancellor's Court, before Sir W. P. Wood, to commit the defendant for a breach of an injunction granted in July last to restrain him from selling eau de Cologne, with labels imitated, or only colourably varied from the label of the plaintiff, the well known Johann Maria Farina, residing opposite the Julich Platz, Cologne (*gegenüber dem Jülichs Platz*), and using that description as one of the distinguishing features of his label. Upon the motion for an injunction, the defendant appeared and submitted to a perpetual injunction, which was accordingly awarded. Evidence was now adduced for the purpose of showing that, within three days after the service of the injunction had been effected upon him, the defendant had sold spurious eau de Cologne in Liverpool, with a colourable imitation of the plaintiff's trade mark label affixed to the bottles.

Mr Daniel and Mr Hetherington appeared in support of the motion to commit for breach of the injunction.

The defendant, who had been served with notice of the motion, did not appear, and the case having been formally proved,

The Vice-Chancellor made the order.

Lozenges: Wotherspoon *et al v.* Gray *et al*—Infringement of Trade Mark.—This action of "Suspension and Interdict" was in the Court of Session before the Lord Ordinary; and it was brought by Messrs Wotherspoon, for the purpose of preventing Messrs Gray from using the name "Victoria," as applied to lozenges. Both parties are extensive confectionery manufacturers. After hearing counsel on both sides, and making "avizandum," Lord Mackenzie pronounced the following judgment:—Finds it is not alleged by the complainers that they held any patent or exclusive right to manufacture and sell the lozenges in question: Finds, that even supposing the complainers had been the first to apply the term "Victoria" to lozenges of their manufacture, they did not thereby acquire a right to the exclusive use of that name, and by calling their lozenges "Wotherspoon's Victoria Lozenges," they cannot prevent the respondents from selling their lozenges as "John Gray & Company's Victoria Lozenges:" Finds that it appears from the printed labels or wrappers founded on by the parties, that the annouucements on the respondents' packages of lozenges are essentially different from the complainers' annouucements, and such as clearly to show that the respondents' lozenges were manufactured by themselves and not by the complainers: Finds, in these circumstances, that the complainers are not entitled to the interdict sought by them: Therefore repels the reason of suspension and interdict, refuses the interdict, and decerns: Finds the complainers liable in expenses, of which allows an account to be given in, and remits to the auditor to tax the same and report.

In a very comprehensive "note," which his Lordship superadds to his judgment, he remarks that the primary use of the word "Victoria" cannot in itself give the users an exclusive right to that appellation, except in so far as it is coupled with the maker's name. Hence, the defendants had a right to make and sell "Victoria" lozenges, so long as they did not mislead the public as to the name of the real makers.

REVIEWS OF NEW BOOKS.

A Short Trip in Hungary and Transylvania in the Spring of 1862. By Professor D. T. Ansted, M.A. 8vo. Allen & Co., London.

Professor Ansted, already favourably known by the several other accounts of foreign tours made by him, has now produced an entertaining and instructive little volume, refering to the very imperfectly explored (by Englishmen, at least,) part of Europe named in its title.

Hungary was, probably, more familiar to the educated Englishmen of the 16th and 17th centuries, through the few who then travelled at all, than it has been in the 19th to ourselves. It was then at once the battle field of Crescent and Cross, and the barrier to Europe against the Turks who threatened to overrun it, and who were, at last, only repulsed under the walls of Vienna. War and revolution, brought about by tyranny and misgovernment, and crushed only by the overbearing weight of another tyranny, that of Russia, have, latterly, given Hungary, and, indeed, the Austrian dominions, an evil name everywhere amongst the class who travel merely for temporary enjoyment.

Ansted tells even these, however, that they may see many parts of this, in many ways, (to the educated man,) most interesting portion of Europe, without any serious risk of losing the *agremens*, or much of the creature comforts they deem so indispensable, and which they find on all the common beaten tracks of travel. Nor does language, or rather the want of it, form a serious difficulty; for although the vernaculars of Hungary are probably the most diverse, heteroclite, and perplexed of any part of Europe, within the Russian border, our author tells us that German will carry one almost everywhere. Highly interesting as Hungary is to the naturalist, the sportsman, the botanist, the ethnologist, and the archeologist, it is not exactly in any of these aspects that it presents itself with an interest peculiar to ourselves, and our special readers.

Hungary is one of the oldest mining countries of Europe. Its gravel deposits, and the sands of such rivers as the Maros or the Berzava, were washed for gold by Sarmatians and Dacians in wild old Pagan days, before the Romans had ever heard of these people probably.

Trajan's column at Rome still attests his conquest over a people who had invaded the empire and levied blackmail upon his predecessor Domitian, and the importance attached to their subjugation; while the Roman occupation is still indicated in Trajan's Bridge over the Danube, with its foundation piles that once grew in Carpathian Beech forests, now, after near two thousand years, silicified into agate; and by the immense ridges and trenches, whence the iron ores were turned out, that were forged into Dacian spears, and, at an after time, into Roman swords.

At far later periods Chemnitz and Nagyag were classic ground with all to whom mineralogy and mining were of interest. The general physical configuration of Hungary is extremely remarkable. Like Bohemia, but upon thrice the scale, it is surrounded, on the north, east, and south, by an almost continuous girdle of mountains in the great Carpathian ranges, which rise, forest-waisted, with primeval oak and beech, and in many places capped with snow, to 7000 or 8000 feet in height.

Into the vast amphitheatre within these, great lateral ranges and innumerable spurs of mountains, penetrate from this surrounding rampart, and streams innumerable take their rise; and uniting into mighty rivers, such as the Danube and the Theiss, traverse the enormous central plain of Hungary—perhaps the largest and the richest in Europe. This vast surface, of deep and rich alluvium for the most part, is not more than two or three hundred feet above the level of the Black Sea or Mediterranean, and were the water of the Danube dammed up at the famous *Eisen Thor*, the Irongate where, with a width of only about three hundred and fifty feet, and a depth of nearly two hundred, its immense volume rushes through the Carpathian barrier, a large proportion of Hungary would become a vast, but shallow inland lake.

It is not very apparent, from Professor Ansted's book, whether he visited this country of enormous natural resources, simply for the pleasure of observation, or with some professioual aim in view.

We incline to surmise the latter, as we find a civil engineer was one of his travelling companions, and his eye seems to have been always intent upon coal. Their first points, and the most careful scenes of their remarks, appear to have been the Vulkan and other passes of the south-east Carpathians, into Wallachia. Railway communication is now complete, by way of Szegedin and Zemesvar, to Baziasch, upon the Danube, opposite Gradistie upon the right bank; but beyond this, the way to Constantinople at present, is only by the steamboats of the great river. The day, however, assuredly approaches, when a great trunk system of railways will be made down through Wallachia and Bulgaria, to unite Western Europe with Constantinople. Such a railway will be one stage upon the route to India, of which,

sooner or later, the Euphrates Valley line will be another grand link. Politically, it would be the most effectual of all safeguards to Turkey against the designs of Russia; but most of all would it be important to ourselves, as a commercial people, in enabling the vast natural riches of Hungary to reach our shipping in the Black Sea. What Hungary is capable of yielding was, in some degree, shown at the late Exhibition; and a distinct idea may be had of the enormous scale and value of its products—mineral and agricultural—by the excellent *resumé* there circulated by Herr Ladislas Korizmics, the vice-president of the Hungarian Commission.

The annual product of Hungary in wheat alone is about 25½ millions of bushels per annum, and the total of grain and farinaceous seeds of various sorts, exclusive of oil seeds, reaches the immense total of more than 150 million bushels. The oil seeds, chiefly colza, produce an average of 40,000 Vienese quintals of oil, and double that weight of oil cake yearly. More than one hundred thousand acres are cultivated with tobacco. While the annual product of wine reaches the enormous figure of nearly 350½ million gallons English. Amongst these are some of the finest wines in the world, including those of the celebrated Tokayer district. Several of those wines since the Exhibition have already reached London, where an enterprising Hungarian merchant, M. Max Greger, of Mining Lane, has already established himself in the trade; and we can speak from personal experience of the excellence both of these red and white, Hungarian wines, several sorts of which are fully equal to the finest wines of Bordeaux, or of some sorts of the Rhine or Mosel.

Wool, flax, hemp, are also vast products, and of timber of the largest scantlings, in beech and oak, there is an exhaustless supply, as soon as the means of transport from the mountain forests shall permit it to reach the Danube. There is not very much said technically in Professor Ansted's book as to the natural products—mineral or otherwise—of Hungary. He does, however, enlarge a good deal upon the coal found in various spots, but particularly in the sandstone and clay formations, which overlay the old crystalline rocks in the basin or valley of the Zsil (pronounced Jil), in the south-eastern Carpathians.

He says—"Thick beds of coal are seen on the hill-sides. Lumps of coal appear in the brooks, black streaks appear when the plough turns up the ground," &c.; and he continues—"The prospects of wealth for this part of Hungary are neither small nor doubtful. So large a coalfield, containing, as it would seem, such excellent coal, cannot, in these days, be overlooked," (pp. 64, 65.)

Much follows to the same effect, and with, as it appears to us, rather a laboured effort to affirm the value of this coal deposit. It is, we think, unfortunate, however, that Professor Ansted gives us no information whatever as to what is the geological horizon of this coal. When we talk in England, and in English, to Englishmen, of "a coal-field," we certainly are generally understood to refer to coal of the great carboniferous limestone formation—*the* coal formation and only one (in Europe, at least) so called. Now, if our own information be correct, this formation is absolutely wanting in Hungary, and the coal that is found belongs to the brown coal series—that is to say, to formations above the Lias.

We have ourselves seen and examined the Hungarian brown coal, and we are bound to say, that for coal of that formation, it is the most surprising in its quality we have ever seen, presenting much more the lithological characteristics of good thin seam Staffordshire coal, or even of certain South Wales coals, than of any coal we have ever seen from any part of the world from the brown coal formation. This is due in Hungary, no doubt, to the close proximity of the old crystalline rocks, probably containing great igneous or metamorphic masses. As brown coal therefore, its quality is surpassingly fine, but should it appear that this coal of the Zsil Valley is also of this formation, we must be aware of the well-known deceptive and uncertain character of the deposit of mineral fuel that, almost proverbially, belongs to the deposits of brown coal. These coal—or brown coal—deposits, whichever they are, appear to be no new discovery; traces are found in this valley of workings of it which appear to remount to Pagan times. Professor Ansted describes several other basins now worked for coal, and more particularly that of Fünfkirchen, in the great central region, and another in the farther north—of these he does not give a very favourable account. In the excellent little general sketch of Hungary with which he concludes, he states that all the Hungarian coals are newer than those of the carboniferous limestone. For ourselves, we have little doubt that the true coal market for Hungary is Westphalia, whence the fine coal there raised can easily reach by railway. We commend Professor Ansted's book to all of our readers, as an interesting readable volume, and we think we have said enough to point out to the large class of those who are interested in foreign engineering and mining undertakings, and in the paths of commerce, that it treats of a country at this moment one of the most promising to enterprise in Europe.—Ed.

MECHANIC'S LIBRARY.

Builders' Prices, 1863, 8vo, 4s, cloth. Skyring.
Exhibitor, International Exhibition, illustrated, 7s 6d, cloth.
Mining and Smelting Magazine, Vol. 2, 8vo, 7s 6d, cloth.
Mines and Mining Companies, Law relating to, 4s, cloth. Arundell.
Organic Nature, Causes of the Phenomena of, cr. 8vo, 2s 6d. Huxley.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

WATER *VERSUS* MERCURY FOR BAROMETRICAL PURPOSES.

I see complaint is made that none of the barometers would foretell the late storm. This is not the first time they have refused to indicate coming wind. Some months since I thought that water could be made more useful than quicksilver in ascertaining approaching weather. The idea was not originally mine, but I have tried to bring the principle into working order at small expense, and what has been done may be useful. I had a light clear glass bottle made, the bulb 9 inches in circumference, with a neck 5 inches long, and exactly half an inch in diameter throughout its whole length. Every inch of this neck was divided into eight parts, giving 40 divisions. This bottle, so marked, was put upside down in a clear hyaciuth-glass, which had in it enough coloured water to submerge half an inch of the neck. Below you have the readings for the last 12 days as carefully taken off, and you will see that the weather has been exactly foretold. For fine weather the coloured water rises in a column in the neck, and for bad weather it sinks. At 15 the word "change" would be suitable. It is very important that the glasses should be carefully made and marked, and that the place where they are kept should be free from sunshine and artificial heat. Frost would, of course, destroy them. The cost of both glasses is, I find, 2s 6d. I have kept a register for nearly five months, and may add that on Sunday, the 19th of October, when we had a very heavy storm of wind and rain, eight of these glasses went down to 0, though the barometers here marked 29.

Chelmsford. JOHN COPLAND.

DECEMBER.

Day.	Water Glass.	Readings from the Quicksilver Barometer.	Thermometer.	Wind.	Weather within 12 hours.	Remarks.
12	26	30·30	45	W.	Fine	Bright.
13	5	30·10	45	S.	Rain all day	—
14	14	30·30	30	S. W.	Fine	Bright; windy.
15	18	30·35	35	S. W.	Fine	Light cloud.
16	15	30·40	38	S.	Fine	Dull.
17	10	30·40	48	S.	Rain	Four hours' light rain.
18	13	30·35	36	W.	Rain	A little rain.
—	0	30 0	50	S. W.	Storm	Taken at 11 o'clock p.m.
19	2	29 65	48	W.	Storm	Showers and wind.
20	2	29 45	38	W.	Storm	The like.
21	17	29·55	30	N. W.	Fine	Windy.
22	25	30·10	32	N.	Fine	Bright.
23	21	30·10	38	N. W.	Fine	Foggy.

All the foregoing were taken at 9 a.m., except the 8th, which was taken at 11 p.m.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

OCTOBER 2.

The President, Mr E. Chadwick, delivered an address.

"Report of the Committee on Technical and Scientific Evidence in Courts of Law," by the Rev. V. Harcourt.—The Committee recommended

that, by a legislative Act, judges should be empowered, on application from a suitor, in causes of a technical character, to convene skilled assessors, the number of whom should be limited to three, and who should give their opinions on the statements of the witnesses in such manner as they should be required to do by the judge, previous to his adjudication of the cause. A Court so constituted might see a necessity in some cases for independent evidence of the facts on which either party relied. The allowing the judge to call in witnesses independent of the parties in such cases, as was done on various occasions by the Courts of Chancery and by Parliamentary Committees, had been suggested by a high judicial authority, and would, in the opinion of the Committee, be a valuable supplement to the preceding provision.

After much debate, the matter was referred back to the Committee, who completely ignore the question of how trial by jury is compatible with their plan.

"On Expectation of Life," by Mr C. M. Willich.

"On the Numerical Mode of estimating Educational Qualifications, as pursued at the Greenwich Hospital School," by the Rev. G. Fisher.

October 3.

"On the Economic Effects of Recent Gold Discoveries," by Mr H. Fawcett.

"On Local Taxation and Real Property," by Mr F. Purdy.

"On the Income Tax," by Mr W. T. Thornton.

"The Tariffs and Trade of various Countries during the last Ten Years," by Mr R. Valpy.

"On the Practicability of a Division of the Employer's Profits amongst the Work-people," by Dr Watts.

October 4.

"On the Pauperism and Mortality of Lancashire," by Mr F. Purdy.

"On the Progress of Instruction in Elementary Science among the Industrial Classes under the Science Minutes of the Department of Science and Art," by Mr J. C. Buckmaster.

"On Endowed Education and Oxford and Cambridge Fellowships," by Mr J. Heywood.

October 6.

"On the Definition and Nature of the Science of Political Economy," by Mr H. D. Macleod.

"On the Utility of Colonisation," by Mr H. Merivale.

"A Statistical Inquiry into the Prevalence of numerous Conditions affecting the Constitution of 1,000 Consumptive Persons when in Health," by Dr Smith.

October 7.

"On the Subject-Matters and Methods of Competitive Examinations for the Public Service," by the President.

"On the Expenses and Social Condition of University Education," by the Rev. W. Emery.

"Statistics which show the increasing Circulation of a Pure and Instructive Literature, adapted to the Capacities and the Means of the Labouring Population," by Mr H. Roberts.

"On the Instruction and Training of the Unemployed in the Manufacturing Districts during the present Crisis," by the Rev. W. N. Molesworth.

"Notice of a General Mathematical Theory of Political Economy," by W. S. Jevons.

"On the Study of Periodic Commercial Fluctuations," by Mr W. S. Jevons.

"On the Prevention of Crime," by Mr E. Hill.

October 8.

"On the Cotton Famine and Substitutes for Cotton," by Mr D. Chadwick.

"Some Statistics of *Zostera marina* as a Substitute for Cotton," by Mr H. Harben.

Section G.—Mechanical Science.

October 2.

The President, Dr W. Fairbairn, opened the proceedings of the Section with an address.

Mr J. Nasmyth described his "Improved Form of Link Motion,"—viz., that which was exhibited in Messrs Humphry & Tennant's marine engine, last year, at South Kensington.

Mr E. E. Allen read a paper "On the Importance of Economizing Fuel in Iron-plated Ships,"—pointing out that a great saving might be effected in the consumption of coals by using a longer stroke engine.

Mr Scott Russell said it was agreed that the short stroke engine was wasteful of steam and fuel.

Dr F. Grimaldi read a paper descriptive of a New Marine Boiler for generating steam of high pressure. His boiler was a cylindrical tubular boiler, with certain arrangements of radial tubes for taking up and conveying the steam, and made to rotate slowly in the furnace on its axis. The advantages claimed were, freedom from priming, smallness of space occupied, superheating the steam, and economy of fuel.

Mr W. Thorold then read a paper "On the Failure of the Sluice in Fens, and on the Means of securing such Sluices against a similar Contingency."

October 3.

Mr J. Oldham read the Report of the Committee appointed last year to make "Tidal Observations in the Humber."

"On the Strains in the Interior of Beams and Tubular Bridges," by the Astronomer Royal.

Prof. D. T. Ansted, M.A., read a paper "On Artificial Stones."

Mr R. W. Woolcombe then brought forward a paper "On Oblate Projectiles with Cycloidal Rotation contrasted with Cylindro-ogival Projectiles having Helical or Rifled Rotation."

Mr Le Neve Foster read a paper, communicated by Mr C. Hart, "On Type Composing and Distributing Machines.

October 6.

Mr W. Smith read, in abstract, the Report of the Steamship Performance Committee.

The Secretary read a paper by Mr C. Atherton, late Engineer of the Royal Dockyard, Woolwich, "On Unsinkable Ships." The author pointed out the importance of having ships made of a material of less specific gravity than water; so that, whatever injury the ship may sustain, so as to admit water, they would never sink, and thus both crew and ammunition or treasure might be saved. He considered such a build would be very valuable for small vessels, which could enter where the large armour-plated ships would be stopped. The idea, he thought, was worthy of consideration.

Dr Fairbairn, the President of the Section, read a paper "On the Results of some Experiments on the Mechanical Properties of Projectiles." He commenced by stating that, in the investigations which had taken place with regard to projectiles and armour-plated ships, one great difficulty that had arisen was to get good plates of sufficient thickness, and vessels of sufficient tonnage to carry those plates. It appeared that they were limited to plates of five inches in thickness; with plates heavier than that, a ship would not be what was technically called "lively." He had attended the experiments at Shoeburyness from the commencement, and they had reference to the force of impact. He would state the results of the more recent experiments, which had not yet been published. The first series of experiments had reference to the quality of the plates and the properties of the iron best calculated to resist impact. There were three qualities required: first, that the iron should not be crystalline; but secondly, that it should be of great tenacity and ductility; and thirdly, that it should be very fibrous. The mean statical resistance to crushing of the two flat-ended specimens of east-iron is 55·32 tons per square inch. The mean resistance of the two round-ended specimens is 26·87 tons per square inch. The ratio of resistance, therefore, of short columns of east-iron with two flat ends to that of columns with one flat and one round end is as 56·52 to 26·87, or as 2·05 to 1,—an extremely close confirmation of Prof. Hodgkinsons' law. Applying this same rule to the steel specimens, it would appear that the flat-ended shot should have sustained a pressure of 180 tons per square inch before fracture. In the experiment it actually sustained 120 tons per square inch without injury, excepting a small permanent set. In the experiments with cast-iron, the mean compression per unit of length of the flat-ended specimens was ·0665, and of the round-ended ·1305. The ratio of the compression of the round-ended to the flat-ended shot was, therefore, as 1·96 : 1, or nearly in the inversed ratio of the statical crushing pressures. Applying this law to the case of the steel flat-ended specimen, it may be concluded that the compression before fracture would have been only ·058 per unit of length. The determination of the statical crushing pressure of the flat-ended steel shot as 180 tons per square inch and its compression as ·058 is important, on account of the extensive employment of shot of this material, size and form in the experiments at Shoeburyness. In the case of the lead specimens, the compression with equal weights was the same whether the specimen were at first round-ended or flat-ended. This is accounted for by the extreme ductility of the metal and the great amount of compression sustained. In regard to the wrought iron specimens, it may be observed that no definite result is arrived at, except the enormous statical pressure they sustain, equivalent to 78 tons per square inch of sectional area, and the large permanent set they then exhibit :—

	Statical Resistance in Tons per Square Inch.	Dynamical Resistance in Foot lb. per Square Inch.
Cast-iron, flat-ended	55·32	776·8
Cast-iron, round-ended	26·87	821 9
Steel, round ended	90·46	2,515·0

In the experiments on the wrought-iron specimens, the flat-ended steel specimens, and the lead specimens, no definite termination was arrived at, the material being more or less compressed without any fracture ensuing. The mean resistance of the specimens of cast-iron is 800 foot lb. per square inch; that of the specimen of steel is 2,515, or rather more than three times as much. The conditions which would appear to be desirable in projectiles, in order that the greatest amount of work may be expended on the armour-plate, are—1. Very high statical resistance to rupture by compression. In this respect, wrought-iron and steel are both superior to cast-iron; in fact, the statical resistance of steel is more than three times, and that of wrought-iron more than two-

and-a-half times that of east-iron. Lead is inferior to all the other materials experimented on. 2. Resistance to change of form under great pressures. In this respect, hardened steel is superior to wrought-iron. Cast-iron is inferior to both. The shot which would effect the greatest damage to a plate would be one of adamant, incapable of change of form. Such a shot would yield up the whole of its *vis viva* to the plate struck; and, so far as experiment yet proves, those projectiles which approach nearest to this condition are the most effective. The President stated that steel shots might be made at a comparatively small cost. M. Bessemer had told him, that if he had a large order he could produce steel shots at a little more than the price of iron; but if the ingots as cast had to be rolled or hammered to give them fibre, they would cost near £30 a ton, instead of £8 or £10 per ton.

Mr J. Nasmyth inquired whether chilled east-iron flat-headed shot had been tried? The process of chilling cast-iron was very simple and inexpensive. If chilled flat-ended cast-iron shot had not been tried, it was very desirable it should be.—Dr Fairbairn said they had not been tried; but he believed that shot thus made being hardened to a certain depth, the velocity being the same, would in striking the object break as if it had not been hardened at all. However, he would have experiments made; and he hoped that before the next meeting of the Association the matter would be proved experimentally.

Mr T. Ashton read a paper "On Projectiles with regard to their Power of Penetration."

A short discussion took place on Mr Thorold's paper "On the Failure of the Sluice in the Fens, and the means of securing such Sluices against a similar Contingency."

October 7.

Mr W. Smith read the Report of the Committee appointed at the last meeting of the Association to inquire into the Causes of Railway Accidents. This report was simply provisional, pointing out the steps now in progress for collecting information.

Messrs Williamson, of Liverpool, made a communication relative to the merits of Wooden and Iron Ships, with regard to cost of repairs and security for life, and in the event of accidents at sea; calling attention, in particular, to an iron ship of their own, the Santiago, which met with a collision, the consequences of which would have been absolute destruction of the vessel had she been of wood; whereas, being of iron and having water-tight compartments, the vessel was able to pursue her voyage, and was repaired at the cost of a few hundred pounds, instead of several thousands, which would have been necessary had she been made of wood, and could have been preserved from foundering,

Prof. W. J. M. Rankine read a paper "On the Form and Motion of Waves at and near the Surface of Deep Waters."

A paper was brought before the Section by Mr C. Vignoles, "On the Practice and Principles of Diverting Rivers, and the Stoppage of Breaches in Embankments."—The author proceeded to describe a method successfully adopted by him in dealing with the River Ebro. The plan he pursued was one very generally adopted at the present day by the Dutch engineers.—namely, gradually shallowing the river throughout at the required spot by means of fascine work. It consists in forming large rafts of fascines, and floating them down to the desired place; loading them evenly with stones, and thus sinking them down to the bottom; and repeating the operation till they rise above the surface of the water. This, he contended, was a more judicious plan than that of piling from the sides to the centre, the result of which was the continual narrowing of the waterway, which caused the tide or stream to rush through with such accelerated violence so as frequently to destroy the works before they were completed; whilst, by the use of fascines, the water was gradually shallowed all over and its force checked by degrees. The Dutch engineers had long since given up the piling system for such purposes.

A paper, by Mr J. Scwell, was read, "On the Prevention of Railway Accidents."—The author considered that the main cause of accidents was the want of punctuality in the trains; and that this arose mainly from the overloading of them, which rendered it impossible that they could keep time. Engines were made to perform certain work and draw certain loads, and if these were exceeded it was impossible that time could be kept. This was a matter that the public could not ascertain for themselves, and he therefore advocated the importance of having engines licensed like boats, omnibuses, etc., by Government, to draw certain loads; and a statement giving that information should be placed conspicuously on the engine. This would prevent the overloading, as it would be in the power of every passenger to see whether the power of the engine was duly apportioned to the carriages it had to draw.

A discussion took place, in which it was objected that such a proceeding would be impracticable, looking at the variety of work which an engine had to perform, by reason of varying inclines, the state of the weather, and the uncertainty as to the weight of carriages and the varying number of passengers.

"On an Improved Painting Telegraph Apparatus," by Mr T. Sortain.

"On the Manufacture of Armour Plates," by Mr A. C. Tylor.

"On Instruments for Observing the Motion of Vessels at Sea, with reference to Sea-Sickness," by Mr J. W. Osborne.

MANCHESTER ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

The Chief Engineer's Report for December last, to the Executive Committee, states that,—

"No explosion has occurred to any boiler under the inspection of this Association during the past year, while no less than 20 explosions are known to have happened in various parts of the kingdom, from which 27 persons have been killed, 47 wounded, and considerable damage done to property. 5,612 boiler inspections have been made; 52 boilers being found in a dangerous state, while, with regard to 226 others, it was necessary, in 145, that the furnaces should be strengthened by hooping; in 52, that the shells should be strengthened by additional stays; and in 29, that the load on the safety valves should be reduced."

During the past month, ending December 31, 1862, there have been examined 439 engines--3 specially; 621 boilers—12 specially, 9 internally, 54 thoroughly, and 546 externally, in which the following defects have been found:—Fracture, 4; corrosion, 33 (1 dangerous); safety valves out of order, 13 (2 dangerous); water gauges ditto, 24; pressure gauges ditto, 9; feed apparatus ditto, 1; blow-off cocks ditto, 32 (1 dangerous); furnaces out of shape, 7 (2 dangerous); blistered plates, 1. Total, 124 (6 dangerous). Boilers without glass water gauges, 6; without pressure gauges, 16; without blow-off cocks, 27; without back pressure valves, 44.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

December 30, 1862.

Mr T. T. Wilkinson, F.R.A.S., said that, in a paper "On the Burnley Coal Field," prepared by Mr Joseph Whitaker, of Burnley, and himself, and read before the Geological Section of the British Association, at Manchester, they gave a sketch of the principal mines in this district, but they purposely omitted all mention of those whose thickness did not exceed one foot. There are, however, one or two of these thinner mines which may hereafter become worthy of notice, and hence he offered the present note as an addition to Mr Hull's valuable synopsis in pp. 133-4 of his "Coal Fields of Great Britain."

Section of Strata near Worsthorne, Burnley.

Strata, composed principally of blue clay, followed by light metals	102 feet.
1. Coal, the "China Bed"	2 "
Strata, consisting chiefly of grey rag and metals	39 "
2. Coal, the bed not named, and overlaid by about three inches of cannel, together	1½ "
Strata, composed mainly of dark rag and metal seating ...	73 "
3. Coal, the "Danby Bed"	2¾ "
Strata, consisting of rag, light blue rock, metals, and black shales	126 "
4. Coal, the Arley, or Habergham mine	4½ "

The bed (2) is the one which has been hitherto omitted; and, if of no other value at present, it may be useful for co-ordination and identification with the seams of coal in other localities.

"On the New Red Sandstone and Permian Formations as Sources of Water Supply for Towns," by Edward Hull.

The paper commenced by pointing to the advantage enjoyed by most of the large towns of the central counties from their geological position, when built on the new red sandstone. First, from being in proximity to coal; second, from having a dry foundation; third, from having easy access to building stone, and, fourth, from the fact of their resting upon natural reservoirs of water stored up in the sandstone itself. The author considered that many of these towns had not taken full advantage of this last-named source of water supply, partly from a distrust of the resources of the rock, and partly from the failure sometimes sustained in consequence of the positions for the wells having been selected without a proper regard to the geological structure of the country.

The excellence of the new red sandstone and the lower permian sandstone as sources of water supply, was shown to depend upon three qualities. 1. Their porousness; 2. Homogeneity, or uniformity of structure and composition; 3. Filtering powers. Each of these were treated of in detail, and with examples from several wells in Lancashire and Cheshire. The author then referred to the failure of the attempts to obtain fresh water at Rugby, and a sufficient supply at Wolverhampton; and he maintained that an abundant supply might have been found at the latter town had the position for the well been selected with due regard to the geological structure of the country.

The author then proceeded to lay down certain rules of general application for the selection of proper sites for wells, and illustrated the subject by reference to a well now being sunk under his direction at Whitmore, for the supply of the railway works and town of Crewe. The position of the well is in a *trough*, both geographically and topographically, and on a four-inch bore hole being sunk to a depth of 148 feet the water ascended to the surface with a head of four feet, and has continued to flow without diminution for the last six months. The well, which is being made within 100 yards of the bore hole, has only reached a depth of 60 feet, but already yields 250,000 gallons per day.

SOUTH WALES INSTITUTE OF ENGINEERS.

JAN. 14, 1863.—"On the Selection and Value of Coke," by Mr Child. "On Long Work," by Mr Hedley. "On Boiler Explosions," by Mr M. Jones.

INSTITUTION OF ENGINEERS IN SCOTLAND.

OCT. 29, 1862.—"Results of an Experimental Inquiry into the Comparative Tensile Strength, and other properties of various kinds of Wrought Iron and Steel," by Mr D. Kirkaldy.

INSTITUTION OF CIVIL ENGINEERS.

JANUARY 13, 1863.—"On Railway Telegraphs, and the Application of Electricity to the Signalling and Working of Trains," by Mr W. H. Preece.

GREENOCK PHILOSOPHICAL SOCIETY.

JAN. 5, 1863.—"On Traces of the Old Glaciers of the Basin of the Clyde," by Archibald Geikie, Esq.

SCOTTISH SHIP-BUILDERS' ASSOCIATION.

JAN. 5, 1863.—A letter was read from the Deputy-Chairman of Lloyd's Committee, requesting the association, as a body, to favour the committee with their views on "Lloyd's Rules for the Construction of Iron Ships," preparatory to an amendment which is now considered necessary, from the increased experience of ship-builders and the committee in the construction of iron vessels. The committee has already requested the ship-builders individually all over the kingdom to submit any suggestions that they might consider advisable; but, for the purpose of meeting the request of the committee to the association in a friendly spirit, and furthering the object contemplated, the association appointed a committee to draw up and submit such suggestions as the association may deem most advisable for the improvement of the construction of iron vessels.

Mr R. Duncan, of Renfrew, then read a paper explanatory of an improved slip dock, and also of a self-acting tide-gauge, by which the exact rise and fall of tide for any height from one foot to 100 feet could be registered with the greatest precision for any length of time. Mr Duncan's models received honourable mention from the jurors of the International Exhibition.

Dr James Gray next exhibited and described a plan for cleaning the bottoms of iron vessels, and preventing fouling. It consists of an ingenious application of pulleys, lines, and brushes, for sweeping the bottom from the water edge to the keel, whether the vessel were at rest or at sea.

GLASGOW ARCHITECTURAL ASSOCIATION.

JANUARY 8, 1863.—"On some of the Causes which effect Architectural Design," by Mr Thomas Gildard.

GEOLOGICAL SOCIETY OF IRELAND.

The first general meeting of the society for the session of 1862-3 took place on the 13th November, at the Museum Buildings, Trinity College. The chair was taken by the Rev. Professor Haughton, president.

The President read a long and interesting paper, entitled, "Remarks on the Granites of Sweden, Norway, and Finland, as compared with those of Scotland and Donegal." He pointed out the extent and importance of the field which existed for the study of physical geology, as distinguished from palæontology. The former had been much more cultivated on the Continent than in England, the palæontological treasures of the latter country having proved tempting to geologists. He had great hopes of progress being made by a study of physical geology, on account of more exact laws, and more precise methods of reasoning being valid in that than in other departments of the science. He hoped to lay before the society that evening assurances, which he had received from geologists in Russia and Canada, to the effect that they believed that Ireland was a key connecting the geologies of Europe and America. He had endeavoured, in common with other members of the Geological Society of London, to bring before that society and the Geological Society of Dublin during the last few years, a number of points bearing on the history of the so-called igneous rocks that are found in Ireland and England; and he believed that their labours had had not been unsuccessful, and that the present session would show that that society would deserve the thanks of geologists everywhere for the zeal with which it had prosecuted that branch of study. They would shortly have before them a paper from a most distinguished geologist, in the service of the Emperor of Russia, Professor Holmberg, of the University of Helsinfors, who had just returned from a five years' tour amongst the Ural Mountains, Siberia, North America, and Finland, and who had done him the honour of placing the paper in his hands to be laid before the society. The learned President, in continuation, stated that during the course of the past summer he received from the Commodore of the Royal Mersey Yacht Club an invitation to accompany him on a cruise to the Baltic, for the purpose of examining the granites of Sweden and Finland, and comparing them with those of Scotland and the north-west of Ireland. He was happy to accept the invitation, and the present paper contained the results of that tour.

ROYAL DUBLIN SOCIETY.

THE first scientific meeting of this society for the session of 1862-63 was held on the 17th Nov., at the Society's House, Kildare-street.

Dr Steele read a paper, communicated by Dr Lawson, Professor of Physiology, Queen's College, Birmingham, on "The Anatomy of the Genus Limax (the Slug)." Before reading the paper, Dr Steele said that every person, whether a member of the society or not, was invited to read communications before the society whenever they were of sufficient value to be made public. Such of the papers read as were of value and importance were published in the journal of the society free of expense to the author, illustrated by the society, and widely circulated through all the leading scientific societies, universities, and libraries of England, Ireland, the Continent, America, and Australia. The paper which he was about to read was one of the effects of this system, being from a gentleman not resident in Ireland, who, on a previous occasion, sent communications to the society.

Mr R. G. Scott read a paper on "The Mining Localities of Donegal," from which we quote the following opening passages:—"Inasmuch as many years have elapsed since the publication of the last mineralogical and mining reports of those which have from time to time appeared under the authority of this society, it may not be amiss to allude to the fact that for a lengthened period, from the beginning of the century to about the year 1830, systematic explorations were carried on by officers of the Royal Dublin Society in various parts of Ireland. Mr Donald Stewart was appointed to this duty in the year 1786, and made several mineralogical tours throughout different districts of Ireland. In the year 1809 Mr (Now Sir) Richard Griffith was appointed mining engineer—an office which he held for many years—and published during that period his well-known reports on the various coal districts of Ireland. Sir C Giesecke, who preceded Professor Scouler, in the professorship of mineralogy and geology, was employed during several successive seasons in making mineralogical tours through such parts of the island as were recommended to his notice by the Committee of Natural History. Having myself been engaged during the past year, in company with Sir R. Griffith, and the Rev. Samuel Haughton, in the preparation of a report on the 'Chemical and Mineralogical Composition of the Granites of Donegal and the Minerals therewith Associated,' in which I have derived great assistance from Sir C. Giesecke's reports, I have thought that it might be interesting to lay before the society this evening a brief account of what has been done, and a list of the mineral localities of the county, embodying in it the two reports of Sir C. Giesecke."

Mr Scott exhibited specimens of the various minerals which he had obtained in Donegal.

THE PEAT IRON.

Mr R. H. Scott exhibited a pig of cast iron made in the Creevelea Iron Works, County Leitrim, which are now under the management of Mr G. Murrall. His specimen derives its peculiar interest from the fact that the fuel used in its manufacture is turf, which has been "prepared," according to Mr Buckland's patent. He said that his attention had been drawn to the subject by seeing the notices in *Saunders's News-Letter* of the 10th and the 13th inst. respectively, of which the former ran as follows:—"The success of the experiments lately made in the adaptation of peat fuel to the manufacture of iron will probably have considerable interest for such of our readers as have directed their attention to the development of this useful and economical process That this will essentially prove complete there is abundant reason to anticipate, as Mr Murrall, the Manager of the Creevelea Iron Company, now reports that the process of smelting the iron ore with the condensed peat fuel has been successfully pursued for four days continuously—indeed, until the entire stock of fuel supplied for the purpose of the experiment had been consumed. Notwithstanding that a very inferior limestone has been employed as a flux, 35 cwt. of pig iron has been produced whose quality is equal to the finest Swedish iron. A sample of the iron thus made (56lbs. weight) by the adaptation of peat fuel, together with specimens of cinders, peculiarly worth notice from their purity, may be seen at Mr Simpson's Seed Warehouse, No. 1 College-green." He then continued:—Thinking that it might be of interest to exhibit this iron at the present meeting, I wrote to Mr Murrall, who referred me to Mr Joseph T. Potts, of Fitzwilliam-square, to whom I am indebted for the statement which I now lay before the Society. It will clearly be understood that for the facts which are therein contained the authorities whom I quote are alone responsible, and I abstain from making any comment on the process. It is as yet only an experiment at these works; and although it seems to be very promising, we must await the results of mechanical experiments on the metal before we can pronounce with certainty as to its quality. A short description of the district in which the furnace is situated may not be without interest to those who are not familiarly acquainted with the geology and topography of that part of Ireland. Creevelea is situated about four miles to the N.E. of Drumkeeran, in the County Leitrim, and in its immediate neighbourhood are situated some of the coal mines of that county. The district is, however, more remarkable for the enormous quantity of ironstone which is found throughout it in a state of very great purity. As to the statistics of the seams of coal, &c., to be found there, most valuable information is to be found in Sir R. Griffith's report on the Connaught coal fields, published in the year 1818; and more recently a very important paper on the same subject was read before this society by Mr Enchan, and published in No. IX. of our journal. I shall now proceed to quote from a Report made by Mr Joseph T. Potts, in September, 1861, when he made a survey of the locality. This gentleman has kindly furnished me with a map, which I have the pleasure of exhibiting, showing the respective positions of the works, the turf bog, and the iron levels. "The works which are represented on the map were erected some ten years ago by a Scotch company, at a very large expense, for the purpose of smelting iron by means of coal, but, owing to the distance of the coal-fields from the works, and other reasons which are not explained, the place was abandoned, and is now in possession of the present company. This consists of a few gentlemen who are desirous of trying whether the manufacture of iron by the use of condensed peat fuel could be carried on with advantage. It only requires a short inspection by the least practised eye to observe that the works which have been erected here are in excellent order, and more than sufficient for the most active operations. I therefore proceeded to examine the mountain-

ous range, being desirous of ascertaining the proximity of the peat to the furnaces, its quality, and the best means for its conveyance to the works. The distance from the end of the 'made road,' marked in the map, to the level of the mountain is three-quarters of a mile, and its distance from the works is one mile and a-quarter. There is clear evidence of an ample supply of ironstone all along the valley, with the vast plain of peat, sufficient, I should say, to supply the most active operations for centuries to come, the bogs varying in depth from five to seven feet. The least depth of bog on the ground over which I passed was three feet. On the extreme summit of the mountain the quality is fibrous for the first two feet, the next much less so, and the remainder hard and close. The proximity of both bogs to the made road below led me to the conclusion that very little expense would be incurred by delivering the peat down by a shoot or tramway, to be manufactured at the point marked in the map, from whence it could be brought to the works when fit for use." A brief account of the works was published by Mr H. Coulter, the Special Correspondent of *Saunders's News-Letter*, in the beginning of this year, in his letters from the West of Ireland, which have since been published in a separate form. At the time he wrote it was proposed to bring down the turf from the bog on an endless chain. This plan has not, however, met with approval, and has been discontinued. The compressed peat fuel is made by a peculiar process, which has been patented by Mr Buckland, and which was to be seen in operation in the International Exhibition. Mr Brunton, who was the exhibitor, has furnished me with the following account of the apparatus and process:—

"Immediately the peat is dug from the bog it is thrown or tipped into a hopper, beneath which is a strainer formed of perforated metal, and within the strainer is an Archimedean screw; at the bottom of the strainer is a small opening through which any very coarse undecomposed roots and fibres, which will not pass through the perforations of the strainer, fall into a waste pipe and are rejected, or may be used for any purpose not requiring superior fuel. By turning the screw within the strainer the small fibres are cut up by the sharp edges of the perforated metal, through which they pass with the decomposed part of the peat, with which they thus become assimilated. A strainer of two feet in diameter, with perforations of one-eighth of an inch diameter, and fifteen to the square inch, contains about 12,000 holes, which are equal to an aggregate aperture of a square foot; a strainer of this size will discharge about eight tons of peat per hour, or nearly one hundred tons in twelve hours. The decomposed peat protrudes through every hole in the strainer, and drops, in vermicular forms, upon an endless band, which delivers the strained peat into a brick machine, which will mould it in any suitable shape or size that may be preferred. The strainer being closed in a heated chamber, with an opening for the escape of steam, the moisture is rapidly driven off from the worm-like strings as they fall upon the band, giving solidity to the moulded blocks of peat as they pass through the die of the brick machine; and their being then at a high temperature, expedites the subsequent process of drying. Very little power is required for the whole operation, which is performed continuously and with great rapidity. The moulded blocks of peat are removed to a drying shed, through which a current of hot, moist air passes; and they soon, without compression, become as hard as oak, and more dense than any peat submitted to hydraulic pressure, the specific gravity being from 1·15 to 1·50, and that of highly compressed peat 1·8. From four to five tons of wet peat, as taken from the bog, are required to make one ton of dry condensed peat, the total cost of which is about 3s 6d. per ton. Peat thus prepared burns very freely, will stand a powerful blast, emits great heat, is smokeless, and produces less ash than the average of coal or coke. It is impervious to water, improves by keeping, and is incapable of self-ignition. From two and a-half to three tons of prepared peat will make one ton of excellent charcoal, the cost of which would be about 12s per ton; but in converting the peat into charcoal, one cwt. of hydrocarbon, or peat tar may be drawn from one ton of peat, the value of which for illuminating and lubricating purposes will greatly reduce, if not entirely cover the cost of the charcoal." The peat when it comes from the machine, is moulded into blocks of the shape of four-inch tiles, and is placed in trellised sheds, open at the sides, where it remains for some days. It is afterwards placed in a stove and dried thoroughly. It is possible that improvements may hereafter be made on this drying process; and it is confidently asserted that the great difficulties which have been hitherto experienced will shortly be overcome, if, indeed, they have not already been surmounted. The peat with which this iron was smelted was charred, and stood the hot blast furnace in a way that surpassed the most sanguine expectations. This sample of iron is the first that has been produced in Ireland, and much credit is due to Mr George Murrall, the company's manager, for his skill and perseverance in producing it.

I have received the following letter from Mr Murrall on this subject:—

"Creevelea Iron Works, Nov. 15, 1862.

"Sir,—Having been employed nearly the whole of my life in smelting pig iron in Staffordshire and South Wales, at iron works, the proprietors of which were particularly careful to produce iron of superior quality, I was selected by the Creevelea Iron Company, whose works are about fourteen miles from Sligo, to carry out the important experiment of smelting iron ore with peat, prepared by a simple process, which has recently been patented. It has long been well known that peat is a remarkably pure fuel, possessing all the elements for making iron of best quality; the difficulty has been to get rid of all the water in the peat, and to produce a sufficiently consolidated material to resist the blast requisite for smelting iron. This has hitherto been attempted by submitting the peat to violent pressure, but these attempts have been unsuccessful. The object has, however, been perfectly attained by the simple process above alluded to, and which is particularly described in the papers forwarded to you. Having prepared a quantity of peat in this mode, and charred it, I conducted my experiment in a cupola furnace, 22 feet high, 3 feet 6 across the boshes, reduced to 18 inches above the hearth. I should have preferred a much larger furnace, which would have presented fewer difficulties, but it was thought desirable to commence operations on a small scale. I pursued much the same course as I should have done if I had been working with coke, using unburnt limestone as a flux, except that my twyers were larger and the blast not so strong, with some few other variations during the process of the trial as were suggested by the working of the furnace. I passed the peat charcoal over a ¾-inch screen, as smaller pieces would obstruct the blast. As soon as I had a few cwt. of melted iron in the hearth, I tapped the cupola and ran out the iron. I was not a little pleased to find that the iron was of such a quality as I never made before, and equal to any charcoal iron I ever saw. I continued for 60 hours to tap the cupola every 6 hours, or thereabouts, and the 10 successive casts were similar in quality. I send you a fair sample of the iron, which will speak for itself. Having myself made in my lifetime about 300,000 tons of good pig iron in Staffordshire and Wales, I feel confident in saying that such iron as I have now made with peat cannot be made with coal or coke. I consider it equal to any Russian or Swedish iron. I believe that the charred peat can be made on a large scale at a less cost than coke, and that more will not be required than is now used of coke to the ton of iron. It is impossible to estimate the benefit to this kingdom, and to Ireland especially, of following out the enterprise, of which I have been delighted to be made the humble pioneer.—I have the honour to be, Sir, yours very obediently,

"George Murrall."

The following letter from Mr Anderson, who tested the Creevelea iron, had been received by Mr Potts:—

"Institution of Civil Engineers of Ireland,
40 Trinity College, Dublin, Nov. 15, 1862.

"Dear Sir,—The pig of Creevelea peat iron, tested in my works this afternoon, carried 14·177 lb. at two feet span. Comparing this result with experiments on cast iron bars made by W. Fairbairn, and reducing the result to his standard, it appears that your raw pig is 7·0-0 below the strength of the best specimens, and 29·0-0 above the worst. I have no means of ascertaining the amount of increased strength obtained by re-melting, but it is always considered to be considerable. The iron is soft and works very nicely, presenting a very close grain. I will cause a Scotch pig to be broken on Monday, in order to obtain a better comparison.—I remain, yours very truly,

"W. Anderson."

"H. T. Potts, Esq."

Dr Steele said it was a curious fact that a century ago, in the year 1764, the Royal Dublin Society offered two prizes for the manufacture of iron. The first was a prize of £30 for the making of the largest quantity of pig iron, not less than twenty-five tons weight, with a preparation of Irish pit coal in imitation of wood charcoal, equally good as that made with wood charcoal, fit for being manufactured into tough bar-iron, and which bar-iron may be sold on the same terms as Swedish. The second was a prize of £20, for making the greatest quantity—not less than five tons—of tough bar-iron with coke from coke pigs, equal in goodness to that made from pigs smelted with wood charcoal. No competitors came forward to compete for these prizes. It was gratifying to find that at the end of a century iron had been made in Ireland—not with coke, but with a preparation of Irish peat—which appeared to be of a very superior quality.

Mr Anderson stated that the result of an experiment which he had made that morning showed that the strength of the Creevelea iron was 40 per cent. over that of ordinary Scotch pig iron; and from what he had seen he had no hesitation in saying that the Crecvelea iron would far exceed any Scotch or English iron in strength. He had visited Creevelea, and could bear testimony to the fact that the works and machinery were in perfect working order. There was one feature peculiarly encouraging with respect to the manufacture of iron by means of peat. The price of charcoal iron for the making of steel was at present £6 10s, whilst that of ordinary pig iron was only £3 2s per ton. Now, as the iron produced by peat charcoal was equal to that obtained by the use of wood charcoal, he saw no reason why the managers of the Creevelea works should not adopt Bessemer's process and convert their iron at once into steel. Even though the cost of the peat charcoal should turn out to be much higher than stated, yet the price which they would obtain for their steel would be such as to yield them a handsome profit.

The following further notice of this so called peat iron, has since appeared in a leading Irish journal—*Saunders' News-Letter*. From this the minute scale upon which the metallurgy has been so far conducted may be appreciated:—

THE PEAT IRON.

The success of the experiments lately made in the adaptation of peat fuel to the manufacture of iron, will probably have considerable interest for such of our readers as have directed their attention to the development of this useful and economical process. That this success will essentially prove complete there is abundant reason to anticipate, as Mr Murrall, the Manager of the Creevelea Iron Company, now reports that the process of smelting the iron ore with the condensed peat fuel has been successfully pursued for four days continuously—indeed, until the entire stock of fuel supplied for the purpose of the experiment had been consumed. Notwithstanding that a very inferior limestone has been employed as a flux, 25 cwt. of pig iron has been produced, whose quality is equal to the finest Swedish iron. A sample of the iron thus made (56lbs. weight) by the adaptation of peat fuel, together with specimens of cinders, peculiarly worth notice from their purity, may be seen at Mr Simpson's Seed Warehouse No. 1 College-green.

Anything that could possibly bring the bogs of Ireland to reasonable profit, covering, as they still do, probably more than one-ninth of the surface—thirty years ago they were calculated to cover one-seventh—is so important that we readily print the above proceedings at considerable length. We must, at the same time, confess our own absolute incredulity as to any result of mercantile or national value coming out of this affair. The attempt to smelt iron with

peat in a condensed form, is no novelty either in Ireland or abroad. It has been, on prolonged trial, uniformly found financially impracticable, and almost so technically. This is not the direction in which to attempt to utilize peat fuel for manufacturing purposes.—Ed.

ACADEMY OF SCIENCES.

The following are the prize questions proposed by this body at its last great annual meeting:—1. Mathematics.—To discuss with care the observations of tides made in the principal ports of France, and compare them to the theory (3000f., papers to be sent in before the 1st of June, 1865); to re-examine the phenomena of capillarity, and compare them to the results of calculation (3000f., 1st of April, 1864); to improve the geometrical theory of polyhedrons (3000f., 1st of January, 1864); to establish a complete and rigorous theory concerning the equilibrium of floating bodies (3000f., 1st of July, 1864). 2. Mechanics.—To introduce some important improvement in the application of steam to the Imperial navy (6000f., 1st of November, 1863). 3. Bordin Prizes.—On some question of optics, at the candidate's choice (3000f., 1st of July, 1864). To determine the direction and relative intensities of electric currents produced by various thermo-electrical substances (3000f., 1st of July, 1864). To effect some improvement in the mechanical theory of heat (3000f., 1st of July, 1864). 4. Natural Philosophy.—On the comparative anatomy of the nervous system of fish (3000f., 1st of September, 1864). To study the changes effected during germination in the constitution of the tissues of the embryo and perisperm (3300f., 1st of April, 1864.) On the production of hybrid animals by means of artificial fecundation (3300f., 31st of September, 1863). 5. Medicine. — To trace the history of Pellagra (5000f., 1st of April, 1964). 6. Medicine and Surgery.—On the application of electricity to therapeutics (5000f., 1st of April, 1866). 7. Surgery.—On the preservation of members by preserving the periosteum (the Academy offers 10,000f.; the Emperor also 10,000f., 1st of April, 1866). 8. Bordin prizes of 3000f. each, to be sent in before the 31st of December, 1863:—On the distribution of the vessels of the latex in the organs of plants; on the anatomical history of coral and other zoophytes of the same family; on the structure of the stems of plants, with a view to determine their respective families.

At the last sitting a communication was received from M. Hoffman, on chrysaniline, a new colouring matter extracted from aniline, itself an artificial base derived from coal tar When aniline has been employed to produce the red called rosaniline, a large proportion of it remains undecomposed under the form of a resinous substance, which it has been found very difficult to analyse. From this compound Mr Nicholson has extracted chrysaniline, a base of a beautiful yellow colour, which M. Hoffman describes as a fine yellow powder, not unlike chromate of lead. It is scarcely soluble in water, but very much so in alcohol and ether. This compound is a well-defined organic base, which forms two series of crystallizable salts, the most characteristic of which are the nitrates, crystallising in needles of a ruby tint. Thus aniline produces three bases—viz., chrysaniline, rosaniline, and leucaniline, each differing from the other by two equivalents of hydrogen. Prince Demidoff sent the Academy a present of a copy of a pictorial archæological album of Tuscany by the pencil of M. André Durand. M. Ozanam wrote to state, in allusion to the communication sent last week by M. Persoz, jun., on the solution of silk, that the ammoniuret of copper also has the property of dissolving both cotton and silk; but that, while the former is dissolved in a very short time, it takes several hours to dissolve silk. Hence another method of determining the composition of a compound tissue of silk, cotton, and wool, the latter being quite insoluble in the ammoniuret. M. Ozanam also announced that he was engaged in endeavouring to turn the solution of silk to account by casting silk stuffs instead of weaving them, or drawing silk threads like wire instead of spinning them, etc. MM. Joly and Musset wrote to request the Academy to annul their last communication on spontaneous generation.

MONTHLY NOTES.

Messrs W. Denny and Brothers, of Dumbarton, have launched an iron screw of nearly 1,400 tons, and have three other large vessels (steamers) in course of construction. The steamer just launched is to be fitted with engines of 200 horse power, by Messrs Denny and Co. The house of Napier has a contract on hand for three iron-plated screw frigates, required for the Turkish Government, and to cost (machinery included) £750,000.

Messrs Caird and Co. have also just launched a screw steamship, of 2,500 tons (builders' measurement), the *America*, for Nordeutschen Lloyds of Bremen, being the fourth vessel of the same size for that company, viz., the *Bremen*, *New York*, and *Hansa*. The *America* is 360 feet in length, breadth of beam 40 feet, and the depth of hold 34 feet. She will be propelled by a pair of direct acting engines, with inverted cylinder, of 500 horse power nominal collectively, capable of being wrought up to give an indicated power of 1,800. Messrs Caird and Co. have on the stocks another steamer of the same dimensions as the *America*, for the Hamburg and American Steam Packet Co.; also a steam clipper for the Loudon, Brighton, and South Coast Railway Co., for carrying mails and passengers between Newhaven and Dieppe, besides five other paddle-wheel vessels for the home trade. This looks as if steam ship building was flourishing, in spite of the distress which at present effects so many other pursuits.

To show what has been done in ship-building, during the past year, in Dumbarton alone, upon the Clyde; and what is promised there for the year now before us, we present the following statement in detail:—

LAUNCHED IN 1862.—IRON VESSELS.

By Messrs William Denny & Brothers—*Rona*, paddle steamer, 1215 tons. Screw steamers—*Memphis*, 1010 tons; *India*, 1010; *Gerard*, 510; *Kurrachee*, 510; *Corinth*, 1544. Total, 5799 tons.

By Mr Archibald Denny—*Pehlwan*, paddle (tug) steamer, 135 tons; *Columbia*, screw steamer, 392; *Ava*, do., 278; *Granite City*, paddle steamer, 463. Total, 1268 tons.

WOODEN VESSELS.

By Messrs A. M'Millan & Son—*Helenslee*, ship, 841 tons; *Caledonian*, ship, 655 tons; *Leven*, barque, 369 tons; *Janet Fraser*, schooner, 107 tons; *Isabella Hunter*, brigantine, 176 tons; *Benlomond*, ship, 1051 tons; *Maggie*, schooner, 105 tons; *Orissa*, ship, 690 tous; total, 3994 tons.

By Messrs Denny & Rankiu—*Chance*, brig, 145 tons; *Haitienne*, brig, 167 tons; *Peep o' Day*, brig, 150 tons; *Christian Rankin*, barque, 340 tons; total, 802 tons.

Iron vessels: total tonnage,	...	...	...	...	7067
Wooden do., do.,	...	...	...	...	4796
Total,	...	...	...	...	11,863

VESSELS BUILDING.—IRON VESSELS.

By Messrs William Denny & Brothers—A screw steamer, 700 tons; two screw steamers, for the Spanish Royal Mail Co., 1900 tons each; a tug for the Calcutta river, 450 tons; a screw steamer for the British India Steam Navigation Co., 300 tons. Total, 5250 tons.

By Mr Archibald Denny—A screw steamer, 600 tons; a screw steamer, 90 tons; paddle steamer, 460 tons. Total, 1150 tons.

WOODEN VESSELS.

By Messrs M'Millan & Son—A ship, 520 tons; a barque, 420 tons; a ship, 650 tons. Total, 1590 tons.

By Messrs Denny & Rankin—A ship, 1100 tons. This vessel, which is built with iron beams in upper and 'tween deck, and iron lower masts, to class 10 years A 1, is nearly ready for launching.

Iron vessels building: total,	...	...	...	...	6400
Wooden do., do.,	...	...	...	...	2690
Total,	...	...	...	...	9090

The tonnage at present in hand, it will thus be seen, amounts to fully three-fourths of the total tonnage launched last year.

As to marine engines, there were made by Messrs Denny & Co. in 1862—For *Rona*, 275 horse-power; *Pehlwan*, 60; *Granite City*, 106; *Memphis*, 170; *India*, 170; *Columbia*, 100; *Gerard*, 120; *Kurrachee*, 120; *Ava*, 60; *Corinth*, 200; also, 1 pair of engines of 100 horse-power, and 1 pair of 40 horse-power, finished and waiting the arrival of vessels; total finished, 1515 horse-power.

Engines at present making by Messrs Denny & Co.—For the screw steamer, by Messrs W. Denny & Brothers, 1 pair of 200 horse-power; for Spanish mail steamers, 2 pairs, each 320 horse-power; for tug steamer for Calcutta, 1 pair of 240 horse-power; for paddle steamer building by Mr A. Denny, 1 pair of 100 horse-power; for screw steamer, 1 pair of 100 horse-power; total, 1280 horse-power.

The great firm of Messrs Burns, of Glasgow, are making great improvements in the marine steam communication between the Clyde and Belfast; and they have now building, three fine steamers, the *Wolf*, the *Fox*, and the *Roe*, for this important route. The *Wolf* is being built by Messrs Napier. She is to be of 690 tons register, and 300 horse-power, drawing, when loaded, 9½ feet of water, and carrying a crew of 34 men, including engineers. She will be on the station this month. The *Fox* is in the hands of Messrs Caird, of Greenock, the builders of the *Lord Clyde*, whose performances have shown her to be the fastest steamer, of her size, afloat. The *Fox* is of 660 tons, and 240 horse-power, with a load draught of 9 feet, and carrying a crew of 31 men. She will be at work in July. The *Roe*, building by the same firm, is of the same size and power, and is to be ready in August. It is worthy of remark, that this most spirited firm has carried the mails, since 1849, free; whilst, before their time, a subsidy of £6000 a-year was paid to the promoters of the Port-Patrick route.

A new yacht is ordered to be built for the use of the Queen during her stay in the Isle of Wight. Messrs Penn have received orders for the engines, (oscillators), 160 horse power.

Since the general introduction of screw propulsion in our navy, it has always been felt that the top hamper of the old-fashioned rigging was a most serious drawback. In case of anything going wrong with the rigging, fouling of the screw is almost certain to occur, and then the ship is disabled. The advent of the turret-ships has, however, led to plans being laid before the Admiralty for masting and rigging our sea-going iron-clad ships on an entirely novel principle, superseding altogether hempen rigging, cordage, and wooden masts, by iron tubing and chain, exactly as iron ships have superseded wooden ones for all future purposes of war. It is proposed in these plans to give the ship tripod tubular iron masts, the central, or foremost, of the three tubes being of sufficient length to act as lowermast and topmost, and without tops or cross-trees. A long wooden topgallantmast fidded abaft the topmast head would carry topgallantsails and royal. Topgallant and royal yards would be of wood, but topsail and lower yards would be built of tubular iron, like the masts; all

three masts and spars to be of equal dimensions. The advantages claimed for the tripod over the ordinary system of masting are,—1. Having no lower stays, they present no obstacle to the fire of the guns in the cylindrical shield or turret, in whatever direction they may be trained. 2. The yards can be braced up nearly fore and aft, or in a line with the keel, enabling the ship, when under steam, to set sail and steer her course, when, with the present rig, she would be obliged to furl her sails. This last position was forcibly illustrated in the escape of the English steamer, *Thistle*, from the United States' corvette, *Tuscarora*, off Madeira, on the 29th November. 3. In action, the wooden topgallantmasts being sent down, the ship is in her fighting trim. Her topsail halliards and sheets leading down between decks through her tubular masts, sail is set and taken in as required by the crew without exposing a man on deck. If all or any portion of the masts and yards are shot away, being of iron, and having no rigging attached to them, they would sink immediately on falling overboard, without a possibility of fouling the screw. 4. On the mast platforms, which are laid on the braces connecting the legs of the tripod, they furnish a set of fortresses for riflemen to repel boarders, etc. 5. From their great strength, they are well adapted for withstanding the shock of a collision when using the ship at full speed as a ram. 6. They will enable a ship to carry a greater spread of canvas, with less weight aloft, than can be done with ordinary masts and rigging. They afford great means of ventilation, are durable as the hull of the ship itself, would not be subject to the effect of climate, and the enormous wear and tear of ordinary masts and rigging would be thus avoided. 7. The masts and yards being all equal in size and fixed at equal distances, the yards cannot lock when braced sharp up, and, the centre of effort of the sails being thrown well forward of the line of resistance of the hull, the ship will wear easily and rapidly, a quality in which our iron ships afloat, and more especially the *Warrior* and the *Black Prince*, are said to be very deficient. The adoption of the tubular tripod masts would also, without doubt, save the enormous annual expense which is now incurred in the deterioration of the rigging of our ships of war kept ready.

Duplex Joint Pins for Ships' Anchors.—The jointed anchor of Porter, improved by Trotman, has gradually worked its way, purely by virtue of its intrinsic merits. Practice, however, has shown that this anchor, great as are its advantages, it is very liable to go wrong in its crown joint, under a heavy strain. Mr Heriott Currie, the engineer of the Northern Lights' steamer *Pharos*, has just drawn pointed attention to this fact. There is indeed no doubt that the pin or axis on which the flukes turn is the part of the anchor which is most liable to failure, and besides the possibility of its giving way from unperceivable defects in the metal of which it is made, there is also a danger of the cutter, which keeps it in its place, dropping out, or of the end of the pin through which the cutter passes being broken off by its accidentally coming in contact with a projecting point of rock. In either way the pin would become loose and might work out, either from a varying strain on the cable, or from the vessel swinging to wind or tide. On board the Northern Lights' steamer *Pharos*, alone, it has happened on two occasions that the shank came home and left the flukes at the bottom, while at another time it was found, when the anchor was brought on board that the cutter had been lost, and the pin itself had nearly dropped out. On the very day before one of the occasions on which the flukes were lost the *Pharos* was anchored on a dangerous lee shore, and had the anchor given way then, instead of the very next time of anchoring, the vessel would in all probability have been totally wrecked. The improvement which Mr Currie proposes, and which would entail little additional expense, is to have two pins to connect the anchor flukes with the shank—one made as at present, and serving as a centre on which the flukes turn—the other fitting tight in the shank and working in a circular slot in the flukes. The pins, as shown in our figures, have their heads so formed as to lock each other in, so that should one of the cutters drop out, or should the point of a pin be broken off (an accident much less likely to happen than before, as the rounded head of the one pin protects the point of the other from injury), the damaged pin will still be of service, as it will be prevented from dropping out by the head of the other; while, should one of the pins even give way entirely, the anchor will still be as secure as any of those at present made with flukes moving on one pin. Fig. 1 is an elevation of an anchor of the form proposed, with two pins; the shank being partly cut away to show the arrangement. Fig. 2. is a longitudinal section of the anchor with two pins through the joint, showing the manner in which one pin locks the other. Fig. 3. shows the pins detached, and with the locking part of the head of each pin forged with a rounded swell, so as more effectually to protect the point of the other. Each cutter in this arrangement passes through the head of one pin and the point of the other. Thus if one joint point should give way the other will save the anchor. The suggestion is a good one, and well worth adoption, care being taken not in any way to weaken the shank by the addition of the second pin.

Fig. 1.

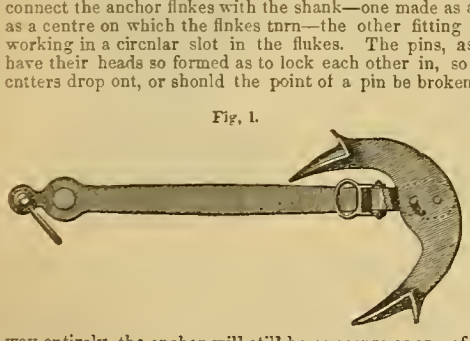


Fig. 2. Fig. 3.

We have received the following letter from New York:—In conformity with your request, I yesterday visited the steamship *Great Eastern*, anchored off White Stone, for the purpose or examining the nature and extent of the injuries received by her in her late collision with a submerged rock, and the character of the repairs rendered necessary and in progress in consequence of that collision; and, having discharged this duty, I submit the following report:—Upon my arrival I examined the hull externally above water and within board to ascertain if it gave evidence of any unresisted stress since my survey of her upon a previous voyage. Having satisfied myself upon this point, I descended from without the hull to within the coffer enclosing the rupture in her bottom, and also from within the hull between the outer and inner plating, again down to the place of rupture, being by this proceeding enabled to examine the full extent of the injuries to the bottom of the hull covered by the coffer and the character of the repairs being made thereto; and, upon a full consideration of the elements presented, I am of the opinion—First, that the effect of the collision is restricted to a partial crushing of two of the webs and rupture of some of the outer plates of her bottom upon the port side, and that the hull of this vessel, beyond the points of rupture, above water and within board, is in no wise injured by the collision; secondly, that the repairs to her bottom, so far as made, have been executed in a manner to restore it to its original security as to leaks and resistance to stress, and that the design both of the method of effecting these repairs and the manner of executing them reflect high credit to all concerned. In connection with this it is proper to refer to the construction of the bottom of the vessel, in order that it may appear how peculiarly adapted it is to meet an injury like that which has occurred to it. Thus, the bottom is composed of an outer and inner plating of equal thickness, with an intervening space of 35 inches, the connection between the platings consisting of 32 webs, or kelsons, running fore and aft, and 13 athwartships, whereby the bottom is divided into a series of apartments, or cells, the communication between them being at command, and from within board by the use of manhole plates. In the event, therefore, of the outer plating alone being ruptured, as in the present case, the inner plating will resist the admission of water within the hull, and the cellular structure of the whole will resist the admission of water between the platings beyond the limits of the cells enclosing the rupture. In communicating the result of my survey to the underwriters here and to Lloyd's, London, I shall report her seaworthiness, provided the repairs now in advanced progress are completed, to be of the same character as before the collision which has involved them. C. H. Haswell, Engineer and Surveyor of Steamers.—To Messrs Howland and Aspinwall, New York. Messrs Howland and Aspinwall, agents for the *Great Eastern*, publish a card in which they explain the nature of the accident to this monster steamship and its relative consequences. They say that the result of the accident was a fracture 85 feet long, and in some places 4 feet broad, and in order to demonstrate that no other vessel affords the same protection against accidents, they remind the public that she delivered nearly 1,000 passengers and 2,000 tons of merchandise (some of which remained on board for a week) without accident or the damage of any portion of her cargo. The vessel, being built with two "skins," is, in fact, one vessel inside of another, and it is alone owing to this construction that she could survive such an accident an hour, the water being unable to penetrate the inner skin. The ship was hove to off Montauk, waiting for her pilot, when she struck a rock which is not marked down on the chart. The injury done was entirely to the ship's bottom, her screw not having been touched. Workmen have been engaged for nearly two weeks past in drilling rivet holes and putting in the iron plates over the fracture in the vessel's bottom. The rivets are put in red hot, as in the original construction of the ship, and the only delay at present is in waiting for iron plates, which can be put on faster than they can be made, owing to the enormous quantity of iron required for the United States' Government. The *Great Eastern's* inner skin (which is the same thickness as the outer one) being unimpaired, it is the opinion of scientific engineers that, even without any repairs, the ship would have been perfectly seaworthy, and could have crossed the ocean without risk.

Anti-Fouling Compositions: The Magæra.—This screw troopship commander Henderson, has been placed in dock at Portsmouth and the bottom examined by the master ship-wright and his staff for the purpose of preparing a report for the information of the Admiralty on the respective and comparative merits of the two descriptions of anti-fouling composition with which it was coated in April last. The starboard side of the ship was then payed with the ordinary composition prepared by Mr Hay, the Admiralty chemist, and the port side with the M'Innes composition, as used on the bottoms of the Cunard steamers. Without anticipating the decision of the Government authorities as to the comparative merits of the two compositions we may state that both sides of the ship are unusually clean and free from marine incrustations, taking into consideration the length of time the compositions have been on. Since 1845, however, when experiments with protecting and anti fouling compositions for the bottoms of iron ships commenced at Blackwall, on Her Majesty's screw yacht *Fairy*, with the compositions of Baron Wetterstedt, Mr Owen, and Mr Ditchburn, up to the present time, when the preparations of Mr Hay, M'Innes, and Peacock and Buchans are those exclusively applied to seagoing vessels in Her Majesty's Navy, not one has been found to answer in all the necessary requirements. Many of the compositions tried have not only failed to prevent the adhesion of foreign matter to an iron ship's bottom, but have actually, or apparently, assisted in the formation and growth on it of marine incrustations. The composition prepared by the Admiralty chemist, the chief ingredient of which is oxide of copper, and which according to the official reports from Malta and the home dockyards, stands first on the list for its preservative and anti-fouling properties, does not altogether prevent the growth of weeds or the attachment of shells to the bottom of a vessel on service in a tropical climate. For the new patent composition of Mr Hay, he claims a great superiority in anti-fouling properties over the ordinary composition in use, but this has not yet been tested fully on the bottom of any sea-going vessel. As the *Himalaya*, which is coated with Peacock and Buchan's composition, will be again placed in the dock adjoining

that in which the *Magœra* is, an opportunity will then exist for comparing the three compositions. The serious damage which has been inflicted upon the bottoms of iron ships coated with anti-fouling compositions, when on lengthened foreign service, by the destruction of the composition and subsequent corrosion of the plates and rivet heads, together with the necessity for meeting the threatened want of increased dock accommodation for our iron ships as speedily and effectively as possible, has induced the Admiralty to devote their immediate endeavours to find some means to render this flocking of iron ships for cleaning and re-coating their bottoms as seldom requisite as possible. Mr Griffiths has laid before the Admiralty a plan for sheathing the bottoms of iron ships with Muntz metal, using a non-conducting material between the protecting metal and the iron-bottom plates, and has received an order to sheath a small iron vessel on this plan as an experiment. The controller of the Admiralty has also called upon Mr Hay, chemist to the Board, to send in to the Admiralty a model of his proposed plan for sheathing the bottoms of iron vessels with copper or Muntz metal. This plan was first submitted to the notice of the Admiralty on the annual visit of the Board, with Lord Auckland at its head, some years since, and was discussed by the Board on their return to London, but its adoption was declined. The decision had just then been arrived at that iron ships were quite useless as men of war or Government screw troopships, and that it was even desirable to get rid of the very few that then were on the navy list. Other plans besides those of Mr Hay and Mr Griffiths are also before the Admiralty, all seeking to attain the same end, although by different means, several resorting to the process of electrotyping in preference to either applying temporary compositions, or the ordinary method of protecting wooden ships by sheets of copper. The two more prominent of these last are known as the "Besley" and "Walen" processes. Both profess to deposit a pure metal, or a combination of metals, by an alkaline process in lieu of the old acid process. The Besley process is already partially adopted by the Admiralty at Portsmouth, tanks and batteries now being at work over the steam factory of Portsmouth dockyard, depositing a coating of metal on the iron bolts that are to be used for fastening the armour plates on the sides of the *Royal Alfred* and *Royal Sovereign*. The success as yet has not been great: in fact the alkaline process as developed by the Besley system is, owing to some cause, slow, and may possibly yet be superseded by the original acid bath. The Walen alkaline process is represented by the floating dock in the Victoria Docks, and its effectual success there seems to be placed beyond a doubt. Mr Walen claims as the merits of his invention, that he can rapidly precipitate a pure metal, or a combination of metals, upon iron of any uneven form, with a perfectly even and bright surface, of any thickness, and indestructible as the metal upon which it is deposited. Mr Walen, while proposing very much that is evidently simple and practicable, and which will doubtless be carried out with but little delay, relative to the preservation of our iron ships in their construction, goes much further than this, and advocates the adaptation of one of the new docks now constructing, as a huge bath, in which an iron ship, when delivered to Government by the contractors, might be at once received, and coated as far above the water line as required, by one process, with an imperishable covering of copper or other protective metal. Whether all or any of these plans should be definitively adopted by the Admiralty, time and experience can alone decide.

The Dissolution of Fibres by Ammoniate of Copper.—Ammoniate of copper (Schönbein's liquor) is capable of dissolving cotton, cellulose, and silk; but whilst it requires a very short time to dissolve cotton, it requires several hours—from three to twelve—to dissolve silk. Wool has been left for fifteen days in the ammoniate without undergoing the least change in its texture or power of resistance. Here then we have the simplest possible means of recognising, in one operation, a triple tissue of cotton, silk, and wool—a practical fact of no mean importance. As in the case of our present solution of cotton—collodion—the silk solution will, we apprehend, speedily find many useful branches of employment.

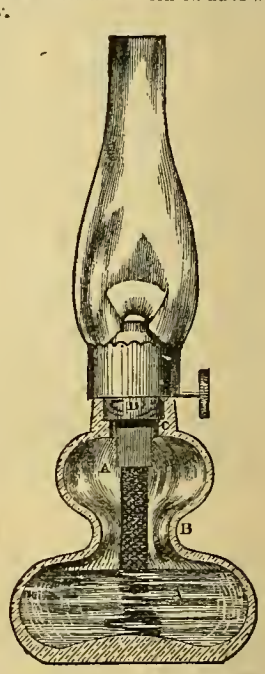
Spectrum Analysis applied to Casting Steel.—The very beautiful scientific discovery of what is now termed "Spectrum Analysis" is not likely to fall to the ground without yielding some sound practical results. In the new process of melting steel, it is important to know the exact moment at which to shut down the cover of the furnace; time must be allowed for the escape of the gaseous products which are injurious to the steel, but if that time be prolonged an injurious effect of another kind is produced. To meet this contingency it has been proposed to test the gases as they fly off by means of the spectroscope; and as soon as the particular colour is observed peculiar to the gas which begins to escape at the moment the molten metal is in proper condition, the manufacturer will then have an infallible sign of the proper moment for closing the furnace. It is impossible not to wish success to this ingenious application of a philosophical experiment to practical uses in the wholesale preparation of the material of hardware. In fact there cannot be a doubt as to the success of the proposed application.

Foreign Philosophical Apparatus.—Amongst the instruments sent to the Exhibition from the Continent, we noticed M. Sire's Polytrope, by M. Hardy of Paris. This was a piece of apparatus intended for the study of the influence exerted by the earth in different latitudes on the motion of revolving bodies, and to demonstrate experimentally certain astronomical phenomena. It illustrates—1, the theory of couples of rotation; 2, the phenomena of the gyroscope; 3, the determination of the meridian and latitude; 4, the precession of the equinoxes; 5, the nutation of the terrestrial axis. The same case also contained an instrument, invented by M. Menton de Brettes, called an Inductional Chronograph, for the purpose of measuring velocity and minute fractions of time. It will measure to the 300,000th part of a second, and its chief application is to ascertain the rate at which a projectile moves. For this purpose it has been adopted by the Artillery Board of Paris, and by the Governments of Russia and Portugal. Amongst the articles contributed by Prussia was an instrument invented by Professor Helmsholtz, made by F. Fressel of Cologne, called the Myographion, an apparatus for registering the contractions of irritated muscles, and for measuring the velocity of the propagation of the nervous agent.

Diamond Borers for Hard Rocks.—Fancy using diamonds for boring rocks! An odd and expensive application of raw material, we might suppose, but this is the case in France, where tubular rods fitted with circular or "crown" cutters of rough diamonds are now successfully employed. As the borer revolves the diamond cutter cuts out a cylinder of stone, which is removed as becomes necessary. It is asserted that bores for blasting, of 2 inches diameter, can be thus bored to a depth of three or four feet in an hour. When examined through a magnifying glass, the cutting diamonds do not seem at all affected by wear. No doubt, such diamonds as are comparatively useless for the purposes of ornamentation might be very properly used in this way. The experiment would, at any rate, be worth trying here.

Curiosities of French Industry.—The manufacture of artificial flowers gives employment to a vast number of hands in Paris. The produce was estimated some years since at £750,000. It has, however, so increased, that notwithstanding prices are greatly reduced, the sales at present amount to £1,500,000 annually. The manufacture of gloves has also greatly increased, and the value of that article exported within the last 30 years is now estimated at more than £2,750,000, of which England takes one half. The porcelain manufacturers established in Paris confine themselves principally to statuettes or ornaments for the drawing-room; but the great manufacturers in the provinces have their depots in the capital, to which they send their produce to be decorated, by which its value is frequently doubled. It is then exported to Spain or Italy, where there is a brisk demand. There is a good demand for French pianos from Belgium, Holland and Italy. The orders for carved furniture are so numerous that the workmen in the Faubourg St Antoine are sometimes at work till eleven at night. It is said that the paper stainers have work on hand which will occupy them until the end of next July.

Bailey's Hydro-Carbon Lamp.—The lamp, which we here engrave on a scale of one-third the actual size, presents an extraordinary example of what can be done by the agency of well-directed machinery, in cheapening manufactured articles. A is a glass reservoir or holder for the oil, or other liquor used, and is formed with a constriction, B, which renders it exceedingly convenient to hold, carry, or hang up; the neck has a ledge, C, internally, which receives a perforated cork, D, into which the burner is tightly fitted. The burners are made of rolled brass, and the rack and pinion are so constructed as to avoid altogether the use of solder in attaching the same to the wick tube. The whole is, apparently, a substantial article, not liable to get out of order. It burns paraffin, photogen, belmontine, petroline, kerosene, and all other hydrocarbon oils. If properly trimmed, it gives a light equal to gas, and perfectly free from smell. It is hard to believe that these lamps are to be had at the rate of 11s per dozen, the glass chimneys at 2s per dozen, and the wicks at 1s 6d per dozen yards—yet such is the case. The lamp is certainly an excellent example of "the results of machinery."



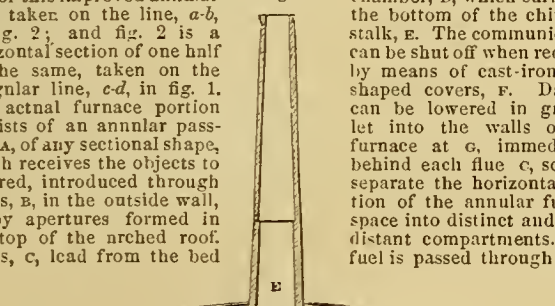
Lead Mines of Great Britain.—The number of lead mines worked in Cornwall in 1861, was 44; in Devonshire, 11; in Cumberland, 79; in Northumberland and Durham, 39; in Westmoreland, 6; in Cheshire, 1; in Shropshire, 9; in Yorkshire, 30; in Somersetshire, 4; and in Staffordshire, 1; making a total for England of 224. As regards Wales, the county of Cardigan had 43 lead mines at work in 1861; Carmarthenshire, 3; Denbighshire, 14; Flintshire, 48; Montgomeryshire, 14; Merionethshire, 3; Pembrokeshire, 1; Radnorshire, 2; Carnarvonshire, 19; making a total for the principality of 147. The Isle of Man, at the same time, had 5 lead mines worked; Scotland, 7; and Ireland, 7; making a total for the United Kingdom of 390, as compared with 380 in 1860, and 264 in 1859. The quantity of ore raised does not show a corresponding increase, having been—For England, 59,503 tons in 1861, against 59,352 tons in 1860, and 63,753 tons in 1859; Wales, 24,219 tons in 1861, against 22,177 tons in 1860, and 20,656 tons in 1859; for the Isle of Man, 2,717 tons in 1861, against 2,810 tons in 1860, and 2,464 tons in 1859; for Scotland, 1,760 tons in 1861, against 1,973 tons in 1860, and 1,946 tons in 1859; for Ireland, 2,403 in 1861, against 2,392 tons in 1860, and 2,457 tons in 1859, making a total (including sundries) of 90,657 tons in 1861, against 88,744 tons in 1860, and 91,381 tons in 1859. The quantity of metallic lead produced from this aggregate of ore was 65,634 tons in 1861, against 63,317 tons in 1860, and 63,233 tons in 1859, the estimated value being £1,445,255 in 1861, £1,412,760 in 1860, and £1,410,095 in 1859.

The New Metal Thallium.—When Mr Crookes made the discovery of this peculiar metal he was of the opinion that it was in reality no metal at all;

since then, M. Lamy, who has investigated the matter, has decided that the discoverer was not far wrong in his views, at least M. Lamy finds it wanting in one of the chief properties of metals—viz., the power of conducting electricity and heat, since the effects of induction developed in the metal are of but slight intensity when the circuit of the pole is successively closed and broken. Thallium and its compounds are diamagnetic; its intensity is enormous, being 11·862, or 0·5 more than lead; its specific heat is 0·0325; its chemical equivalent, 204. The aqueous solutions of its salts are not precipitated either by alkalies, or alkaline carbonates, or by the yellow and red ferrocyanides of potash. But hydrochloric acid produces an all but insoluble white precipitate, which is a protochloride; iodide of potassium, chloride of platinum, and chromate of potash, yield yellow and insoluble precipitates. Zinc precipitates thallium for its solutions, especially from that of the sulphate, in brilliant luminæ variously ramified. Thallium combines with oxygen in two different proportions. The protoxide is soluble in water, to which it imparts alkaline and caustic properties. It is yellow if hydrated, and black in the contrary case. If heated in concentrated alcohol, a part of it is dissolved, and a curious compound produced, called *thallic alcohol* by M. Lamy. It is a limpid oil, possessing great refractive power and a caustic taste. Its density is 3·50. The black peroxide is obtained by burning thallium in oxygen; it is composed of one equivalent of the metal and three of oxygen; it is insoluble and melts at a blood red heat, losing some of its oxygen. The carbonate of thallium is soluble in water, and crystallises in long prismatic needles of greyish yellow. The nitrate is the most soluble salt of this metal; there are three chlorides, and one sesquichloride, crystallising in fine yellow hexagonal plates; its density is 5·90.

Messrs Hoffmann & Licht's Annular Furnaces.—A model of this invention (which has been patented in this country) was placed in the Zollverein department of the International Exhibition, and received a prize medal on the ground of ingenious design. Fig. 1 of the subjoined engravings is a vertical section of this improved annular kiln, taken on the line, *a-b*, in fig. 2; and fig. 2 is a horizontal section of one half of the same, taken on the irregular line, *c-d*, in fig. 1. The actual furnace portion consists of an annular passage, A, of any sectional shape, which receives the objects to be fired, introduced through doors, B, in the outside wall, or by apertures formed in the top of the arched roof. Flues, C, lead from the bed of the furnace to the smoke chamber, D, which surrounds the bottom of the chimney-stalk, E. The communication can be shut off when required by means of cast-iron bell-shaped covers, F. Damper can be lowered in grooves let into the walls of the furnace at G, immediately behind each flue C, so as to separate the horizontal section of the annular furnace space into distinct and equidistant compartments. The fuel is passed through apertures, H, which are formed in the top of the arch—thence through channels, which are formed by the objects to be burned, to the bed of the furnace in which a certain number of air passages are cut to produce a free current to all parts of the furnace. Let there be, for instance, twelve doors, then there will be the same number of flues communicating with the chimney-stalk, and just as many slits, G, in the arch for the reception of the plate damper. Such a furnace would be divided into twelve parts. Let us suppose that bricks are being baked by a fire in full operation, and that the doors leading to the compartments, 1 and 2, are open—No. 1, for filling them with fresh bricks, and No. 2, for taking out the baked bricks. The compartments, 3, 4, 5, and 6, which are all filled with baked bricks, being gradually cooled by the air entering through the doors of No. 1 and 2, and passing over warmer and at last very hot bricks, it will follow that the furnace fire is supplied with atmospheric air almost as hot as the furnace itself. In the compartment 7, the fire is burning and when its contents are baked, the No. 8 will already be heated to such a degree that the fuel introduced from the top is instantaneously inflamed. The compartments, 9, 10, and 11, will be heated one after another by the hot air which passes through them, and imparts heat to the contents of these compartments, and then rushing to the last compartment, No. 12; the air, by the pushing down the damper, G, is made to escape through the open flue into the chimney. No. 1 is then filled again, the damper between 12 and 1 is lifted, and that between 1 and 2 lowered. The bell, F, above the mouth of the flue, No. 11, must be lowered, and that of No. 1 lifted. The opening or door, B, of No. 1 must then be closed, and that of the compartment, No. 3, opened; the contents of which will be sufficiently cooled to be taken out, while No. 2, which is empty, can be filled again. In this manner, the operation of baking bricks, or other articles, may go on continuously. Amongst the advantages claimed for a furnace of this construction are, a saving of time, of fuel, and in the original cost.

Fig. 1.



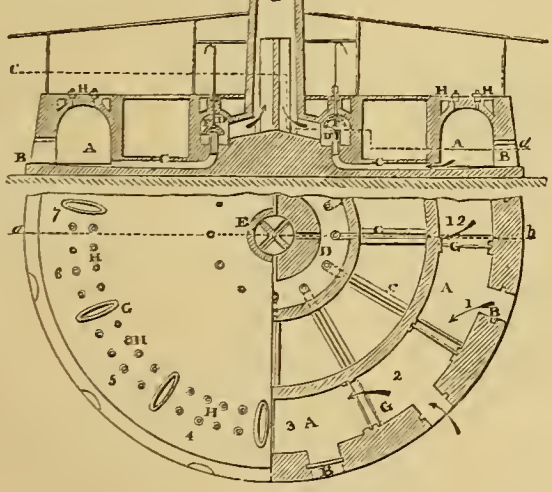


Fig. 2.

British Coal Mining.—It is estimated that 83,635,214 tons of coal were raised in the United Kingdom last year. Of this amount Durham and Northumberland, with 271 collieries, contributed 19,144,965 tons; Cumberland, with 28 collieries, 1,255,644 tons; Yorkshire, with 397 collieries, 9,374,600 tons; Derbyshire and Nottinghamshire, with 180 collieries, 5,116,319 tons; Leicestershire, with 11 collieries, 740,000 tons; Warwickshire, with 16 collieries, 647,000 tons; Staffordshire and Worcestershire, with 580 collieries, 7,253,750 tons; Lancashire, with 373 collieries, 12,195,500 tons; Cheshire, with 39 collieries, 801,570 tons; Shropshire, with 66 collieries, 829,750 tons; Gloucestershire, Somersetshire, and Devonshire, with 112 collieries, 6,514,025 tons; Wales, with 398 collieries, 8,561,021 tons; Scotland, with 424 collieries, 11,081,000 tons; and Ireland, with 46 collieries, 123,070 tons. The coal production of the empire appears to have largely increased during the last eight years. Thus in 1854, with 2,397 collieries worked, 64,661,401 tons of coal were raised; in 1855 with 2,613 collieries, 64,453,079 tons; in 1856, with 2,829 collieries, 66,645,450 tons; in 1857, with 2,867 collieries, 65,394,707 tons; in 1858, with 2,958 collieries, 65,008,649 tons; in 1859, with 2,949 collieries, 71,979,765 tons; in 1860, with 3,009 collieries, 84,042,698 tons; and last year, with 3,052 collieries, 83,635,214 tons. Of this vast quantity, only 7,560,758 tons of coal, 286,150 tons of coke, and 79,717 tons of patent fuel were exported, the remainder being absorbed at home. France was last year our best customer for coal, having taken 1,436,160 tons (this year the exports in the same direction have been somewhat reduced, in consequence of the use of French coal for the Imperial navy); Denmark came next, with 542,567 tons; Hamburg, 514,427 tons; Prussia, 439,096 tons; Italy, 417,629 tons; Spain and the Canary Islands, 403,238 tons; America (Atlantic ports), 349,931 tons; Russia (northern ports), 342,513 tons; the foreign West Indies, 262,952 tons; Holland, 262,868 tons; Sweden, 214,004 tons; British India, (continental territories), 199,069 tons; Turkey, 174,686 tons; the British North American colonies, 165,824 tons; Brazil, 157,281 tons; Norway, 135,221 tons; the British West Indies, 127,768 tons; Malta, 115,731 tons; Portugal, the Azores, and Madeira, 108,794 tons; and Hanover, 100,312 tons. Our other foreign customers took less than 100,000 tons each.

Pig Iron Manufacture of Great Britain.—The total production of pig iron in the United Kingdom last year was estimated as follows:—Northumberland, 73,260 tons; Durham, 312,030 tons; the North Riding of Yorkshire, 234,656 tons; the West Riding of Yorkshire, 142,865 tons; Lancashire, 109,377 tons; Cumberland, 55,165 tons; Derbyshire, 129,715 tons; Shropshire, 140,791 tons; North Staffordshire, 187,700 tons; South Staffordshire, 395,650 tons; Northamptonshire, 7,730 tons; Gloucestershire, 23,163 tons; Wiltshire and Somersetshire, 17,330 tons; North Wales, 46,658 tons; South Wales, (anthracite production), 59,740 tons; South Wales (bituminous production), 825,560 tons; Scotland, 950,000 tons. The total thus arrived at is 3,712,390 tons. Welsh pig iron realized on the average last year £3 10s; Scotch pig, £2 9s 7d; Cleveland pig, £2 17s; and Staffordshire pig, £3 11s 3d per ton. The market value of the production was, therefore, calculated to be £11,508,400. Northumberland had last year 7 out of 8 furnaces in blast; Durham, 32 out of 60; the North Riding of Yorkshire, 26 out of 33; the West Riding of Yorkshire, 27 out of 34; Lancashire, 10 out of 12; Cumberland, 8 out of 13; Derbyshire, 24 out of 37; Shropshire, 22 out of 31; North Staffordshire, 23 out of 32; South Staffordshire and Worcestershire, 114 out of 182; Northamptonshire, 3 out of 4; Gloucestershire, 3 out of 9; Wiltshire, 2 out of 4; and Somersetshire, 1 out of 2; making a total for England of 303 out of 471. In Derbyshire, 5 out of 12 furnaces were in blast; Glamorganshire, 9 out of 13 (anthracite), and 59 out of 78 (bituminous); Brecknockshire, 3 out of 7 (anthracite), and 10 out of 17 (bituminous); Carmarthenshire, 2 out of 4 (anthracite); Pembrokeshire, none out of 2, and Monmouthshire, 54 out of 74 (bituminous); making a total for Wales of 142 out of 212. In Ayrshire, 35 out of 43 furnaces were in blast; in Lanarkshire, 75 out of 98; in Fifeshire, 4 out of 12; in Linlithgowshire, 4 out of 4; in Stirlingshire, 6 out of 7; in Clackmanuanshire, none out of 3; and in Haddingtonshire and Argyleshire, none out of 2; making a total for Scotland of 124 out of 169. The average for the year is of course the basis of this calculation.

Improved Surgical Instrument.—The following notice gives account of an extremely ingenious and often valuable instrument, by which the existence of lead of a bullet, or part of it, may be made certain in a deep wound, when it might be mistaken by the probe alone for bone. A steel pear-shaped rimer at the end of a probe, with deep cut angular teeth that would hold the lead cut out by its rotation until withdrawn, would probably be better than the white and rough "parian" top. Professor Nèlaton, in a late clinical lecture, made some interesting observations on the case of General Garibaldi, with reference to the methods he had adopted to set at rest the question so long agitated as to the presence of the projectile which had inflicted the wound. M. Nèlaton on his first visit had fully convinced himself that the ball was still in the wound, and at what distance from its surface. Percussion with an instrument gave out

a dull heavy sound, very different from the clear thin sound which would have been produced had there been simply a necrosed portion of bone. On returning to Paris M. Nélaton however looked for some means of equally convincing others. He had contrived a *sonde*, with a roughened extremity like a file, which, by a slight rotary movement, would remove some particles of the body it came in contact with. This contrivance was, however, superseded by another; it consisted of a *sonde* with its termination in a small olive-shaped body, made of white unvarnished porcelain, and capable of receiving a stain which would not be easily effaced from a metallic body like lead. This instrument was forwarded to M. Zanetti, and it was in this way that the professor and his colleagues fully convinced themselves that M. Nelaton's opinion was well-founded; and by adopting the method which he had proposed of gradual dilation they had at last happily succeeded in removing the projectile.

Earnings of Railways.—What Railways are doing only really becomes known to us when we see their earnings in the aggregate. The traffic receipts for the year 1862 on railways in the United Kingdom amounted on 11,386 miles to £28,850,322, being at the rate of £2534 per mile; and for the year 1861, on 10,811 miles of railway, to £28,263,374, being at the rate of £2614 per mile, showing an increase in the aggregate length of 575 miles and of £586,948 in the receipts; which increase, however, is less than half the average increase of railway traffic during the last 20 years. The increase in the traffic receipts of 1861 over those of 1860 amounted to £686,591, and in the receipts of the latter year over 1859 to, £2,000,683 showing a considerable falling off in the usual progressive increase of traffic receipts during 1862 and 1861, in consequence of the depression of trade; but the falling off in the total receipts of last year would have been much more considerable were it not for the International Exhibition, which for several months had operated favourably on the railways having their termini in the metropolis. Up to the 4th of May last the traffic on the Great Eastern showed a decrease of £2668, the Great Northern a decrease of £26,858, the Great Western a decrease of £268, The London and North Western a decrease of £54,979, the London Brighton, and South Coast, an increase of £9947, the London and South-Western an increase of £1459, the Midland a decrease of £41,126, and the South-Eastern a decrease of £17,864, as compared with the corresponding period of the preceding year. During the International Exhibition, from the 4th of May to the end of October, the receipts on the Great Eastern showed an increase of £35,265, the Great Northern an increase of £57,031, the Great Western an increase of £143,256, the London and North-Western an increase of £154,184, the London, Brighton, and South Coast, an increase of £44,338, the London and South-Western an increase of £80,998, the Midland an increase of £40,200, and the South-Eastern an increase of £62,294, making together a total increase of £617,706 as compared with the corresponding period of 18 1.

What our Railways do.—Last year, 1,902.069 passenger trains, travelling 44,594,359 miles, and 1,222,617 goods trains, travelling 42,973,819 miles, were run in England and Wales; 275,825 passenger trains, travelling 5,044,655 miles, and 276,152 goods trains, travelling 6,558,777 miles, were run in Scotland; and 174,445 passenger trains, travelling 4,416,462 miles, and 30,882 goods trains, travelling 1,553,338 miles, were run in Ireland. We thus arrive at the amazing aggregate of 105,141,440 miles, as the railway work of the British islands for 12 months. Astronomical calculations indicate that the earth is 95,000,000 miles from the sun, and the unwearied locomotives accomplished this immense distance with an odd 10,000,000 miles to spare. Further, it would appear, that they traversed nearly 3¼ miles in every second which elapsed during the year! This prodigious activity was not, however, attained without a great effort, and taking every item of working expenses into account, it appears that every mile traversed involved an outlay of 2s 7¼d. The 12 great companies contributed to the year's labours as follows:—The Caledonian ran 38,489 passenger trains, which traversed 1,013,858 miles, and 104,689 goods trains, which traversed 2,342,663 miles, or 3,286,521 miles in all; the Great Eastern ran 118,680 passenger trains, which traversed 2,951,069 miles, and 52,312 goods trains, which traversed 2,286.719 miles, or 5,237,788 miles in all; the Great Northern ran 17,306 passenger trains, which traversed 2,715,124 miles, and 28,446 goods trains, which traversed 3,605,505 miles, or 6,320,629 miles in all; the Great Western (including the South Wales and West Midland) ran 190,787 passenger trains, which traversed 5,498,132 miles, and 92,360 goods trains, which traversed 4,141,129 miles, or 9,639,261 miles in all; the Lancashire and Yorkshire ran 181,896 passenger trains, which traversed 3,415,300 miles, and 120,402 goods trains, which traversed 3,001,020 miles, or 6,416,320 miles in all; the London, Brighton, and South Coast ran 136,956 passenger trains, which traversed 2,364,091 miles, and 23,210 goods trains, which traversed 407,026 miles, or 2,771,117 miles in all; the London and North-Western ran 228,036 passenger trains, which traversed 7,959,484 miles, and 195,888 goods trains, which traversed 7,724,804 miles, or 15,684,288 miles in all; the London and South-Western ran 174,663 passenger trains, which traversed 3,113,898 miles, and 55,152 goods trains, which traversed 1,297,899 miles, or 4 411,797 miles in all; the Manchester, Sheffield, and Lincolnshire ran 55,301 passenger trains, which traversed 1,296,008 miles, and 33,376 goods trains, which traversed 1,375,810 miles, or 2,671,818 miles in all; the Midland ran 132,941 passenger trains, which traversed 3,487,256 miles, and 151,933 goods trains, which traversed 5,398,190 miles, or 8,885,446 miles in all; the North-Eastern ran 141,956 passenger trains, which traversed 3,313,154 miles, and 119,854 goods trains, which traversed 6,329,233 miles, or 9,642,387 miles in all; and the South-Eastern ran 102,649 passenger trains, which traversed 2 390.500 miles, and 9,392 goods trains, which traversed 691,217 miles, or 2,991,717 miles in all.

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING JANUARY 29, 1863.

(Compiled expressly for the Practical Mechanic's Journal.)

	1st week.			2nd week.			3d week.			4th week		
	£	s.	d.	£	s.	d	£	s.	d.	£	s.	d.
IRON.												
Bars, &c., British, per ton.	6	10	0	6	10	0	6	15	0	7	10	0
Nail Rods,	7	0	0	7	0	0	7	10	0	7	10	0
Hoop,	8	0	0	8	5	0	8	10	0	8	5	0
Sheets,	9	0	0	9	0	0	9	0	0	9	10	0
Pig, No 1, Wales,	4	0	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	5	0	7	5	0	7	10	0	7	10	0
Rails,	5	7	6	5	10	0	5	0	0	5	0	0
Pig, No 1, Clyde,	2	12	6	2	12	0	2	13	0	2	13	6
Swedish in bond,	10	5	0	11	10	0	11	0	0	11	0	0
STEEL.												
Swedish, in kegs,	15	10	0	15	10	0	15	0	0	15	0	0
In faggots,	16	10	0	16	10	0	16	10	0	16	10	0
Spelter, ingot,	17	10	0	17	10	0	17	15	0	18	0	0
Zinc, sheet,	23	10	0	23	15	0	24	10	0	2	10	0
COPPER,												
Sheathing bolts, pr lb.,	0	0	11	0	0	10¾	0	0	10¾	0	0	10¾
Bottoms,	0	0	10¾	0	0	11	0	0	11⅛	0	0	10¾
Old,	0	0	9	0	0	9	0	0	9	0	0	8¾
Tough Cake, per ton,	93	0	0	92	0	0	92	0	0	92	0	0
Tile,	98	10	0	98	0	0	98	0	0	98	0	0
TIN.												
English blocks, per ton, duty free,	111	0	0	111	0	0	112	0	0	112	0	0
Bars in barrels,	112	0	0	112	0	0	113	0	0	112	0	0
Refined,	116	0	0	116	0	0	117	0	0	116	0	0
Banca, in bond,	115	0	0	115	0	0	116	0	0	115	0	0
Straits, ditto,	114	0	0	113	0	0	113	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	9	0	1	9	0
Coke. IC.	1	2	6	1	3	0	1	2	6	1	2	6
LEAD.												
English pig,	20	10	0	20	0	0	21	0	0	20	0	0
Sheet,	21	0	0	21	10	0	20	10	0	21	5	0
Spanish pig, in bond,	19	10	0	20	0	0	20	5	0	20	0	0
TIMBER—PER LOAD.												
Teak,	15	10	0	16	0	0	16	0	0	15	10	0
Quebec, red pine,	3	5	0	3	5	0	3	5	0	3	5	0
" yellow pine,	3	0	0	3	0	0	3	15	0	3	15	0
St. John, N.B., yellow,	5	0	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	0	0	5	0	0	5	5	0	5	10	0
" Birch,	4	0	0	4	0	0	4	0	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	4	0	0	4	0	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	10	0
Deals, per C, 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	0	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	0	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	10	0	11	10	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	10	0	23	10	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	48	0	0	48	0	0	48	10	0	48	0	0
" yellow,	43	0	0	45	0	0	45	0	0	45	0	0
Sperm,	82	0	0	83	0	0	82	0	0	82	0	0
Cod,	39	10	0	41	0	0	41	0	0	41	10	0
South Sea,	38	0	0	38	0	0	39	0	0	38	10	0
Olive, Gallipoli, per tun,	58	10	0	59	0	0	60	0	0	61	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	51	10	0	51	10	0	52	0	0	52	10	0
Rape pale foreign,	52	0	0	52	0	0	51	10	0	52	0	0
Linseed, per cwt.,	1	18	6	1	19	0	1	19	0	1	19	3
Rough Turpentine, per cwt,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	15	0	4	0	0	4	0	0	4	0	0
Hemp Manilla,	34	0	0	33	0	0	34	0	0	35	0	0
Jute,	22	0	0	22	0	0	22	0	0	22	15	0
Hemp Rope,	24	0	0	24	10	0	25	0	0	25	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

2d December, 1862.

3229. J. and J. Craven, and Jonas Robinson, Clayton Mill—Looms.
3230. G. F. Blumberg, Canon Street West—Producing designs on glass.
3231. John Wheatley, Munich—Ships of war and armour plates.
3232. Thomas Cook, Manor Place—Envelope folding machinery.
3233. G. T. Bousfield, Brixton—Permanent ways.—A com.
3234. G. T. Bonsfield, Brixton—Discharging guns or ordnance.—A com.
3235. Dugald Graham, Edinburgh—Steering ships or vessels.
3236. A. P. Charles, Wapping—Candles and night lights.
3237. R K. Cantley, Thorney—Electro thermal baths.—A com.
3238. H. J. Simleck, Osborne Place—Cigar and pipe lights.
3239. Benjamin Browne, King William Street—Knobs of door locks.—A com.

3d December, 1862.

3240. Henry Wilde, Manchester—Electro-magnetic telegraphs.
3241. A. T. Becks, Birmingham—Cutting or shearing plates of metal.
3242. R. B. Thomas, Anderton—Turning over the leaves of music.
3243. C. F. Claus, Fearnhead—Carboy hampers
3244. Alexander Morton, Arbroath—Lawn mowing machines.
3245. W. H. Browne, Alwyne Road—Gas stoves.
3246. I. I. Abadie, Paris—Imitation lace, &c.
3247. A. F. Eden, Threadneedle Street—Taking minute photographic pictures and magnified pictures of microscopic objects.

4th December, 1862.

3248. C. H. Roeckner, Bristol—Coffer dams.
3249. Henry Swan, Bishopgate Street Without—Stereoscopic apparatus.
3250. John Grant, Maidstone—Turntables for portable railways.
3251. R. D. Kay, Accrington—Endless machine blankets.
3252. James Braddock, Draylesden—Separation of impurities from the water employed in steam boilers.
3253. F. D. Delf, Liverpool, and T. C. Gibson, Ramsey—Storing oils.
3254. Gabriel Lewal, St. George's Road—A hot air apparatus.—A com.
3255. Henry Castelbon, Paris—Manufacture of tiles and bricks.—A com.
3256. John Robinson, Liverpool—Ships and vessels.
3257. John Biggs, Joseph Johnson, Thomas Richardson, and Thomas Arnold, Leicester—Manufacture of warp fabrics.
3258. Richard Wallis, Basingstoke—Loading and unloading vessels.
3259. Richard Hornsby, jun., Grantham—Cutting turnips.
3260. T. G. Webb, Manchester—Articles of pressed glass.

5th December, 1862.

3261. Matthew Tildesley, Willenhall, Stafford, and Edmund Sharpe, Swadlincote—Earthenware knobs.
3262. Louis Christoph, Paris, William Hawksworth, Linlithgow, and G. P. Harding, Paris—Drilling, drawing, and rolling metals.
3263. E. B. Wilson, Parliament Street—Railway wheels.
3264. T. E. Blackwell, Orsett Terrace—Barometers.
3265. J. M. Rigby, Manchester—Pressing fibrous materials.
3266. Phineas, Cowan, Hammersmith Bridge Soap Works, Barnes—Purifying gas.
3267. W. J. Smith, Brooklands Cottage, Sale—Collars, cuffs, and wristbands.
3268. Edmund Walton, Wood Street—Wearing apparel for the neck.
3269. Charles Galleti and Pranco Stefano, Charles Street—Furniture.

6th December, 1862.

3270. H. A. Bonneville, Paris—Stockings and socks.—A com.
3271. Robert Thorp, Liverpool—Coating for steam boilers.
3272. J. and M. Craig, Kilmarnock—Manufacture of clay.
3273. George Wright, Peckham Rye—Preparation of food for cattle.
3274. William M'Naught, Rochdale—Washing textile fabrics
3275. James Campbell, Belfast—Hackling flax.
3276. John Burchall, St. Helen's, and Edward Borrows, Sutton—Propellers.
3277. E. and W. Ullmer, Castle Street—Printing machines.
3278. Richard M'Clintock, Dublin—Carriage axles.
3279. R. E. Donovan, Castleknock, Ireland—Prevention of railway accidents.
3280. John Joce, Colchester—Artificial sea water.
3281. William Palliser, Dublin—Screw bolts.

8th December, 1862.

3282. George Lowry, Salford—Hackling flax.
3283. J. L. Budden, Fenchurch Street—Motive power for propelling.—A com.
3284. John Sellars, Pendlebury—Manufacture of paper.
3285. Peter Todd, Wheelton—Pickers for looms.
3286. R. A. Brooman, Fleet Street—Kneading machines.—A com.
3287. G. A. Huddart, Brynkir, Carnarvon—Buttons.
3288. Charles Sanderson, Sheffield—Bands for driving machinery.
3289. W. E. Newton, Chancery Lane—Preserving animal substances.—A com.
3290. John Hilliar, Balsall Heath, Worcester—Hinges, joints, &c.
3291. John Hilliar, Balsall Heath, Worcester—Ventilating.
3292. E. T. Hughes, Chancery Lane—Electro-galvanic apparatus.—A com.
3293. J. A. and C. L. Kiesling, Liverpool—Renewing files and rasps.
3294. J. H. Johnson, Middlesex and Glasgow—Steam generators.—A com.

9th December, 1862.

3295. Thomas Wingate, jun., Glasgow—Dredging machinery.
3296. Victor Mirland, Belgium—Rhubarb paste.
3297. M. F. Benton, Percy Street—Gunpowder.—A com.
3298. William Clark, Chancery Lane—Photographic apparatus.—A com.
3299. R. A. Brooman, Fleet Street—Treating liquorice root.—A com.
3300. George Jeffries, Norwich—Breech-loading fire arms.
3301. John Howard, John Bullough, and Thomas Clegg, Accrington—Preparing fibrous materials to be spun.
3302. J. M. and E. D. Syers, Liverpool—Deodorizing oils.
3303. Peter Effertz, Manchester—Making bricks, tiles, &c.
3304. W. E. Newton, Chancery Lane—Fire-arms.—A com.
3305. E. B. Wilson, Parliament Street—Rolling metals.

10th December, 1862.

3306. John Lamb, Newcastle-under-Lyne—Tissue paper.
3307. William Inglis, Montreal—Steam boilers.
3308. L. A. Losage, Paris—Fruit jellies and preserves.
3309. J. R. C. Taunton, Birmingham—Metallic bedsteads.
3310. S. B. Whitfield, Birmingham—Dovetail joints
3311. Mark Osborne, Birmingham—Cast iron fenders.
3312. A. P. Price, Lincoln's Inn Fields—Colours.—A com.
3313. David Chalmers, Dundee—Textile materials.
3314. W. A. Turner, Lawrence Pountney Lane—Cutting or paring starch.
3315. William Clark, Chancery Lane—Umbrellas.—A com.
3316. John King, Heanor, Derby—Signalling on railways.
3317. Edward Toynbee, Lincoln—Extracting oils and animal manure.

11th December, 1862.

3318. Isaac Spight, Glandford Briggs, Lincoln—Horse hoes.
3319. William Tristram and Henry Brereton, Halliwell—Sizing yarns.
3320. J. R. Breckon, Darlington, and Thomas Douglas, Crook—Fire bricks.
3321. R. A. Ronald, Glenpatrick—Printing fabrics.
3322. Robert Clark, Langloan—Boring, winding, and lifting.
3323. A. W. Burgess, Strand—Preparation of anchovies.
3324. John Imray, Bridge Road—Mixing and kneading.
3325. William Goulding, Leicester—Ploughs.
3326. T. E Vickers, Sheffield—Ordnance.

12th December, 1862.

3327. George Winiwarter, King Street—Portable houses, &c.
3328. Henry Sanderson, Sheffield—Table knives and forks.
3329. J. E. Roussel, Paris—Looms.—A com.
3330. James Gaskell, Blackburn, and Henry Walmsley, Great Harwood—Regulating the tension of yarn in weaving.
3331. Charles Hancock, West Street, and S. W. Silver, Bishopgate Street—Electric insulation.
3332. Abel Mills, Seaham Harbour, Durham—Reefing and furling sails.
3333. George Clark, Craven Street—Defence of ships and batteries.
3334. Samuel Fox, Deepcar, Sheffield—Gas retorts.

13th December, 1862.

3335. John Brown, Sheffield—Armour plates.
3336. J. W. Baker, Bury, Lancaster—Spinning cotton.
3337. John Brown, Sidney Street—Hydraulic machinery.
3338. Ernest Thorold, Lee, Kent—Drill braces.
3339. Charles Corbet, Dublin—Rails for railways.
3340. Russell, Aitken, Cambridge Street—Locomotive engines.
3341. John Petrie, Rochdale—Washing wool.
3342. J. J. Thompson, Manchester—Cutting meat for pies.
3343. W. E. Newton, Chancery Lane—Repairing railways.—A com.
3344. Michael Henry, Fleet Street—Propellers.—A com.

15th December, 1862.

3345. M. J. Roberts, Pendarren House, Brecon—Preparing and spinning.
3346. William Bestwick, Manchester—Braiding machines.
3347. Richard Stansfield and John Dodgeon, Todmorden—Looms.
3348. George Buchanan, Bucklersbury—Crushing sugar canes.
3349. William Phelps, Nottingham—Locks.
3350. Michael Hyams, Bath Street—Cigars and tobacco.
3351. E. B. Wilson, Parliament Street—Rolling metals.
3352. Robert Kirk, Glasgow—Checking the motion of railway carriages.

16th December, 1862.

3353. John M'Innes, Liverpool, and E. F. Prentiss, Birkenhead—Distillation of oils.
3354. J. Farley, Bolton-le-Moors, and J. Crowther, Bradford—Steam engines.
3355. G. C. Warden, Islington—Ornamenting and waterproofing fabrics.—A com.
3356. J. S. and S. Hancock, Sheffield—Anti-garotte knives.
3357. Oswald Dickin, Middleton—Table fork.
3358. J. J. Lemon, New Compton Street—Book holders.
3359. W. and A. Smedley, Nottingham—Textile or looped fabrics.
3360. William Hudson, Henry Moore, Christopher Catlow, and Samuel Newbury, Burnley—Looms for weaving.
3361. J. L. W. Thudichum, Kensington—Collecting human excreta.
3362. G. C. Wallich, M.D., Kensington—Deep sea sounding.
3363. Rudolph Schomburg, Onslow Terrace, and Adolph Baldamus, Surrey Terrace—Treatment of oils.
3364. Heinrich Jorns, Tessin Grand Duchy of Mecklenburgh Schwerin—Clocks.

17th December, 1862.

3365. Robert Hattersley, Manchester—Classing printers' types.
3366. William Tongue, Bradford—Preparing fibrous materials.
3367. Augusto Albini, Birmingham—Breech-loading fire-arms.
3368 Coleman Defries, Houndsditch—Lamps.
3369. Thomas Knowles, Ashton-under-Lyne—Preparing and spinning.
3370. J. R. Hampson, Manchester—Securing bales.
3371. James Thorne, Cardington Street—Regulating the flow of gas.
3372. John Ramsbottom and George Hacking, Accrington—Registering the flow of fluids.
3373. J. W. Hadwen, Kebroyd Mills, near Halifax—Spinning and doubling.
3374. T. C. Barraclough, Manchester—Spinning tobacco.—A com.
3375. Fédor De Wyldé, Great College Street—Preservation of lead surfaces.—A com.
3376. Leonard Latter, Leigh—Ploughs.
3377. Robert Wheeler, High Wycombe—Ploughs.
3378. Henry Burton, Princes Terrace—Castors for furniture.
3379. G. A. Huddart, Brynkir—Buttons.
3380. William Clark, Chancery Lane—Holders for lamps.—A com.
3381. C. J. L. Leffler, Gefle, Sweden—Armour for ships.

18th December, 1862.

3382. Edward Precht and Victor Toepken New York—Friction matchos.
3383. Edmond Lepainteur, Paris—Dyeing textile materials.
3384. John Clayton, Wolverhampton—Reverberatory furnaces.
3385. Edward Habel and Edmund Suckow, Manchester—Spinning and doubling.
3386. George Russell, Glasgow—Cranes.
3387. W. V. Wilson, Jubilee Street, and F. A. Manning, Leadenhall Street—Colouring matters.
3388. J. and A. Brierley, Spa Mill, near Huddersfield—Carding engines.
3389. Jules Pernod, Avignon, France—Purpurine.
3390. John Savory, Bond Street—Treatment of the throat and lungs.—A com.
3391. Josepb Longland, Landport—Street lamps.
3392. S. C. Lister, Manningham—Spinning fibrous materials.
3393. A. V. Newton, Chancery Lane—Transmitting power.—A com.
3394. Isaac Holden, Bradford—Combing wool and other fibres.
3395. Isaac Holden, Bradford—Washing wool
3396. J. L. W. Thudichum, Kensington—Preservation of beer.

19*th December*, 1862.

3397. W. S. Longridge, Ambergate—Rolling tyres and rings.
3398. E B. Wilson, Parliament Street—Forging metals.
3399. David Davidson, Woodcroft, Edinburgh—Telescopes for fire-arms.
3400. A. V. Newton, Chancery Lane—Attaching metal eyelets to cloth.—A com.
3401. Joseph Dalton, Brooklyn, U.S.—Knitting machinery.

20*th December*, 1862.

3402. J. B. Morrison, United States—Washing machines —A com.
3403. F. W. Harvey, High Street—Connecting rudders to ships.
3404. A. T. Blakely, Montpeber Square—Breech-loading orduance.
3405. Joshua Nettleton, Sloane Square—Stoves.
3406. James Michaelis and Joseph Rubino, Tower Royal—Locks for purses, &c.
3407. John Cowpe, Mill End, Lancaster—Breaking up waste fabrics.
3408. A. V. Newton, Chancery Lane—Automatic toy figures —A com.
3409. John Platt and William Richardson, Oldham—Scutchers or beaters of cotton.
3410. William Perkins, Margate—Substitute for turpentine.

22*d December*, 1862.

3411. F.C Bakewell, Haverstock Terrace—Communications by means of electricity.
3412. John M'Lean, Broxburn—Obtaining oil from shale.
3413. William Francis, Burslem—Cutting soap.
3414. A. S. Stocker, Wolverhampton—Rolling iron.
3415. G. E. M. Gerard, Paris—Threads from vulcanized india rubber.
3416. E. R. Dann, Nottingham—Goffering apparatus.
3417. R. A. Brooman, Fleet Street—Stoves,—A com.
3418. Matthew Clark, Glasgow—Treating waste liquors obtained when dyeing turkey red colours.
3419. J. B. Dalhoff, Copenhagen—Cutting files.
3420. Charles Farrar, John Street—Treating fibrous materials.

23*d December*, 1862.

3421. Charles Pieper, West Gorton—Steam governor.
3422. Frederick Parker, Cambridge—Carriages.
3423. R. A. Brooman, Fleet Street—Colouring matter.—A com.
3424. C. A. F Collette, France—Collette's lace.
3425. John Patterson, Beverley—Crushing or grinding minerals, grain. &c.
3426. E. B. Wilson, Parliament Street—Malleable iron and steel.
3427. George Haseltine, Chancery Lane—Converting petroleum into gas.—A com.
3428. Josepb Whitley and J. W. Burton, Leeds - Railways and wheels.
3429. Samuel Russel, Pimlico—Stereoscopes.

24*th December*, 1862.

3430. T. C. Hinde, Cardiff—Carbonic oxide furnaces.
3431. Samuel Haslam and Alfred Eatough, Bolton—Preparing cotton.
3432. G. H. Birkheck, Chancery Lane—Surveying instruments.—A com.
3433. John Broadbent, Manchester, and Joseph Robinson, Latchford—Cleaning cotton.
3434. F. N. Gisborne, Adelaide Place—Indicating speed of ships.
3435. A. P. Tronchon, Paris—Fire arms.
3436. J. S Smith, Britannia, Lancaster—Looms.
3437 W. C. Galloway, Glasgow—Pianofortes.
3438. William Henderson, Glasgow—Iron and steel.
3439. William Clark, Chancery Lane—Applying heat to the feet in boots —A com.
3440. Harper Twelvetrees, Bromley—Washing machines.
3441. John Fairless, Newcastle-upon-Tyne—Milking cows.
3442. Robert Lakin and John Wain, Manchester—Spinning and doubling.
3443. Ebenezer Stevens, Cheapside—Preparing dough.
3444. James Taylor, Stalybridge—Carding engines.
3445. J. and W. Lord, Bolton—Fluting rollers.
3446. J. H. Johnson, Middlesex and Glasgow—Stamping or marking paper.—A com.
3447. D. G. Hope, Grays—Motive power.
3448. A. V. Newton, Chancery Lane—Skates.—A com.
3449. John Platt and William Richardson, Oldbam—Pulverizing artificial manures.
3450. C. J. Denton, New Broad Street—Revivifying animal charcoal.
3451. Robert Knox, Swinton Street—Metallic pens.

26*th December*, 1862.

3452. William Clark, Chancery Lane—Fire-arms.—A com.
3453 C. F. Varley, Fortess Terrace—Electric telegraphs.
3454. E. T. Losehy, Wood Street—Ascertaining pressure of the atmosphere.
3455. John Swainson, Newton Stewart—Pill boxes.

27*th December*, 1862.

3456. W. H. Samson, Wittersham—Cultivating land hy steam power.
3457. M. F. A. Courtois, Paris—Candles and torches.
3458. J. and S. Freemantle, Gosherton—Propelling vessels.
3459. James Petrie, Rochdale—Slide valves.

29*th December*, 1862.

3460. Matthew Ker, Camden Street—Wardrobes.
3461. J. G. Taylor, Paris—Dress fastenings.
3462. J. H. Riddell, Cheapside—Cast metal pipes.
3463. J. H. Riddell, Cheapside—Stoves.
3464. A. W. Sleigh, Paris—Ships, vessels, and batteries.
3465. Frederick Tolhausen, Paris—Petroleum as fuel.
3466. George Haseltine, Chancery Lane—Cartridges.—A com.
3467. C. E. Wilson, Monkwell Street—Wearing apparel for the neck.
3468. W. E. Newton, Chancery Lane—Preserving organic substances —A com.
3469. William Billinghurst and Josephus Requa, United States—Portable hattery.

30*th December*, 1862.

3470. John Johnson, Sheffield—Surface refrigerator.
3471. James Robson, jun., South Shields—Fittings for stove grates
3472. J. H. Johnson, Middlosex and Glasgow—Ingot moulds.—A com.
3473. H. A. Bonneville, Paris—Saddles.—A com.
3474. F. B. Anderson, Birmingham—Watches and time keepers.
3475. W. and H. Bowser, Glasgow—Coating iron or steel.
3476. William Mould, Belmont, Lancaster—Folding and measuring fabrics.
3477. J. E. Carter, Brownlow Mews—Chimney tops.
3478. Westley Richards, Birmingham—Fire arms.
3479. William Clark, Chancery Lane—Governing apparatus.—A com.
3480. Charles Beslay Paris—Steam engines.

31*st December*, 1862.

3481. Reuben Bottomley, Rochdale—Twisting and doubling.
3482. W. B. Adams, Holly Mount—Railways and tramways.
3483. Frank Applegate, Bradford-on-Avon—Woollen cloth.
3484. J. S. Smith and Joseph Hardman, Britannia, Lancaster—Power looms for weaving.
3485. J. W. P. Field, High Holborn—Breech-loading fire arms.
3486. William Clark, Chancery Lane—Railway trains —A com.
3487. J. M. Napier, York Road—Heating apparatus.
3488. Frank Jaques, Nelson Terrace—Cases for pipes, cigars, &c.
3489. Francis Loret, Belgium—Double weft-forks.
3490. William Malthy, Camberwell—Extinguishing fires.

1*st January*, 1863.

1. R. H. Collyer, Alpha Road—Manufacture of paper.
2 W. H. Brown, Sheffield—Battery plates.
3. George Allcroft, New Church Row—Pressure and vacuum ganges
4. M. E Bowra, Upper Norwood, and A. E. Francis, Tokenhouse Yard—Elastic fabrics.
5. J. T. Smith, Lee—Motive power.
6. Robert Faulds, Glasgow—Traction engines and common road locomotives.
7. J. J. Southgate—Kensington—Portable fire escapes.
8. James Jones, Rhodes—Finishing textile fabrics.
9. William Soutter, Birmingbam—Planishing metals.
10. William Rohinson, Birmingham—Glasses for lamps.
11. J. E. Baker, Cheapside, and James Landon, Crosskey Square—Boots and shoes.

2*d January*, 1863.

12. W. A. Distin, Tavistock Row—Tobacco pipes.
13. F. C. Bakewell, Haverstock Terrace—Burning oils.—A com.
14. Charles Eyland, Walsall—Buckles.
15. Henry Lyon, Baltimore, U.S.—Packing cigars.
16. A. Bamford, R. Bromley, R. Taylor, and J. Lett, Rochdale—Looms for weaving.
17. E. T. Hughes, Chancery Lane—Designs upon velvets, cloth, etc.—A com.
18. W. H. Muntz, Millhrook—Sheathing vessels.
19. H. J. Sergeant, Manchester—Finishing silk fabrics.
20. J. E. Dowson, Dowgate Hill—Metal piles, columns, and shafts.
21. R. C. Ransome, Ipswich—Reaping machines.—A com.
22. A. S. Bolton, Birmingham—Wire.

3*d January*, 1863.

23. Harry Jones, Manchester—Steam engines.
24. Edwin Skull and Edwin Mealing, High Wycombe—Chairs and other seats.
25. William Philippi. Prussia—Bearings and axle hoxes.
26. Stephen White, Suffolk Grove—Purifying and refining oils.
27. William Astrop, Juhilee Street—Paper.
28. C. B. Clough, Lewyn Offa Mold—Smoky chimneys.
29. W. T. Smallware and C. B. Weaver, Fazeley—Crinoline skirts.
30. W. E. Newton, Chancery Lane—Cannon and other fire arms.—A com.

5*th January*, 1863.

31. E. B. Keeling, Gray's Inn—Lighting balls, theatres, etc.
32. Henry Yates, Birmingham—Shovels and spades.
33. J. A. Cooper, Trowbridge—Fihre from plants.
34. John Howard and John Bullough, Accrington—Warping machines.
35. Henry Blacktin, Bradford—Preserving valuable property at sea in case of shipwreck.—A com.
36. Antoine Monnet, France—Twisting and throwing fibres.
37. Henry Bessemer, Queen Street Place—Pressing, Moulding, embossing, shearing, and cutting metallic and other substances.
38. Humphrey Chamberlain, Langley Fawley—Generating and condensing steam and evaporating liquids.
39. David Nevin and William Coppin, Londonderry—Cleaning flax, hemp, etc.

6*th January*, 1863.

40 J. A. Munn and J. D. Cobb, Gresham Street—Automatic figures.—A com.
41. W. E Newton, Chancery Lane—Magnetic electric telegraphs —A com.
42 C. T. Judkins, Ludgate Street—New alloys.—A com.
43. James Eckersley, Westhoughton—Spinning silk, cutting pile fabrics, and weaving fibrous materials.
44. John Leigh, Manchester—Treatment of gas.
45. T. and T. Vicars, and Thomas Ashmore, Liverpool—Manufacturing bread.
46. J. A Knight, Chancery Lane—Printing presses.—A com.
47. Matthew Hodgart, Paisley—Pressing cotton —A com.
48. E. V. Gardner, Berners Street—Petroleum and mineral oils.
49. J. G. Dahlke, Battersea—Bricks, tiles, &c.—A com.
50. George Turner, Northampton—Making leatber.
51. Joseph Whitworth and W. W. Hulse, Manchester—Ordnance
52 J. H. Johnson, Middlesex and Glasgow—Rocket torpedos.—A com.

7*th January*, 1863.

53. John Neale, Kings's Road—Capsules —A com.
54. T. F. Cashin, Sheffield—Crinoline steel.
55. William Crahtree and James Crowther, Todmorden—Dressing textile fabrics.
56. W. S. Bruce, Bishopgate Street—Lucifer matches, fusees, and boxes.—A com.
57. Thomas Storey, Lancaster—Waterproof and ornamental fahrics.
58. William Clark, Chancery Lane—Media for advertising.—A com.
59. G C. Grimes, Wandle Terrace—Manufacture of matches.
60. G. A. Huddart, Brynkir—Buttons.
61. Thomas Aveling, Rochester—Traction engines.
62. George Dowler, Birmingham—Match hoxes.
63. G. T. Bousfield, Brixton—Skate fasteners.—A com.
64. Henry Harhen, Oxford Villa—Fibrous material.
65. J. H. Johnson, Middlesex and Glasgow—Permanent way of railways.—A com

8*th January*, 1863.

66. Roderick Grogan, Hereford Road North—Propellers for vessels.
67. Liveras Hull, United States—Treatment of ground caoutchouc.
68. Alexander Guild, Dundee—Cleaning flax, hemp, &c.—A com.
69. Cecil Allen, Basinghall Street—Railway signals.
70. R. T. Monteith, France, and R. Monteith, Manchester—Aniline dyes.—A com.

9*th January*, 1863.

71. John Punshon, Pemberton, Lancaster—A balance cylinder and valves for steam engines.
72. Charles Worssam, Commercial Wharf—Lithographic press.
73. W. H. Tucker, Southampton Street—Locks, knohs, and spindles.
74. Richard Thomas, Berners Street, Oxford Street—Rendering hair "wavy."
75. C. E. Gray, Great Suffolk Street—Wringing machines.
76. E. A. Goupil, Paris—"Spherical wheel."
77. Matthew Cartwright, Islington—Alarums.
78. D. B. Parsons, Upper Thames Street—Reaping and mowing machines.
79. E. T. Hughes, Chancery Lane—Printing woven fabrics, paper, etc.—A com.
80. Daniel Collinge, Oldham—Preparing cotton.
81. W. H. Moreland and John Chappell, Loop Bridge Mill, near Belfast—Winding, warping, heaming or dressing machines.
82. G. B. Price, Bedford—Sights for fire arms.
83. William Tasker, Waterloo Iron Works, near Andover—Harrows.
84. Michael Henry, Fleet Street—Furnaces.—A com.

PRACTICAL MECHANICS JOURNAL

2ND MARCH 1863

Second Series

Vol. VII.

AIR FURNACES FOR THE FUSION OF STEEL,

BY M. ALFRED SUDRE, PARIS.

Plate 297.

Fig.1.

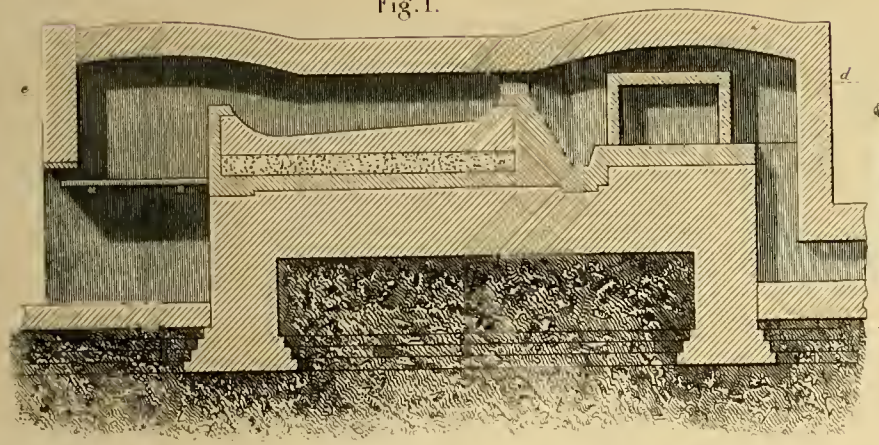


Fig.4.

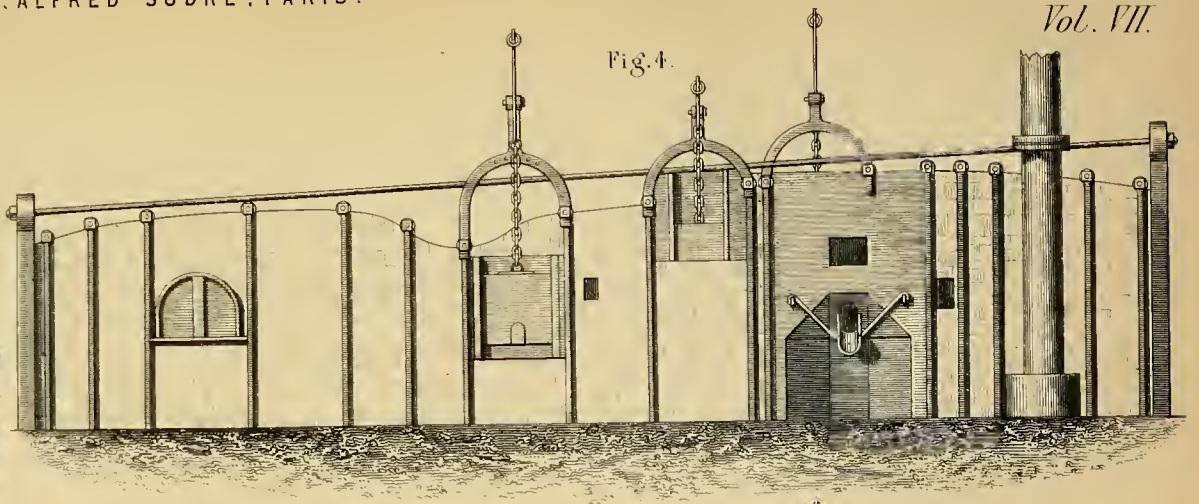


Fig.2.

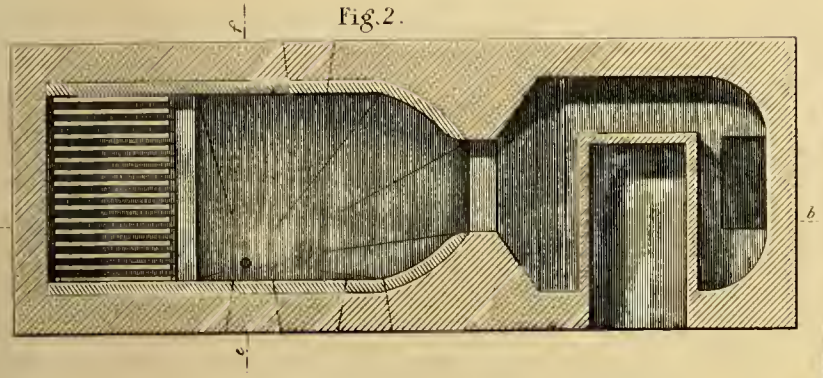


Fig.5.

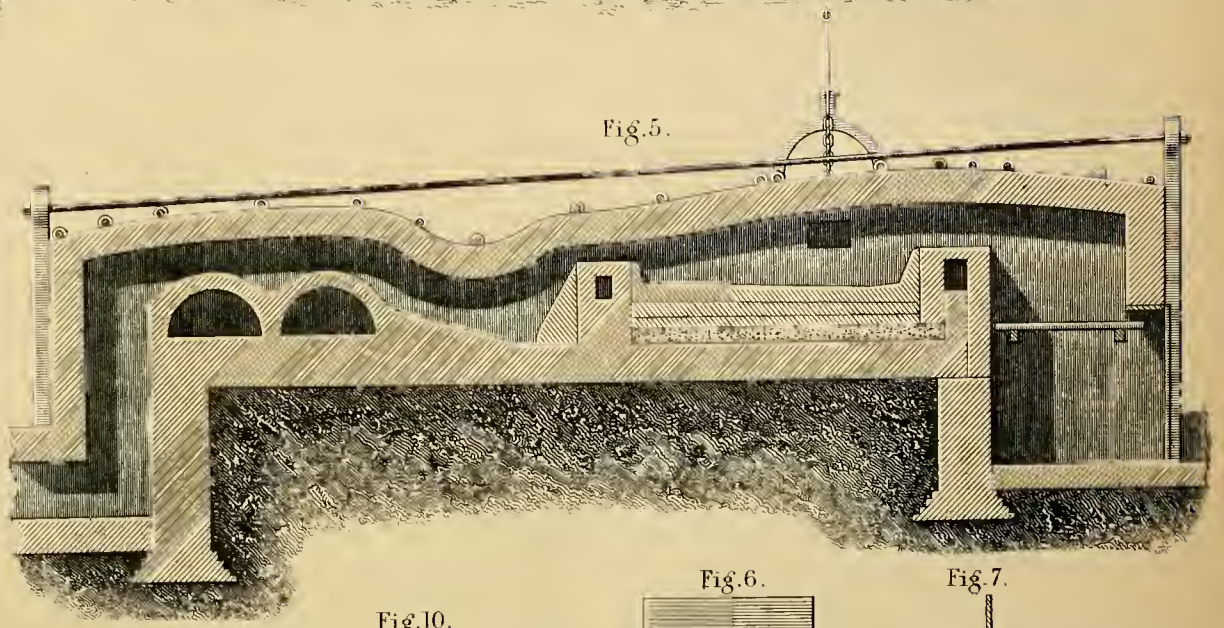


Fig.3.

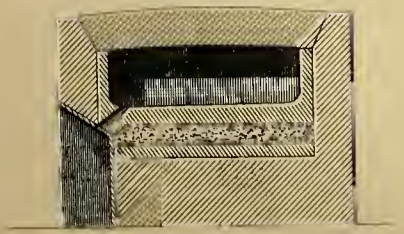


Fig.8.

Fig.9.

Fig.10.

Fig.6.

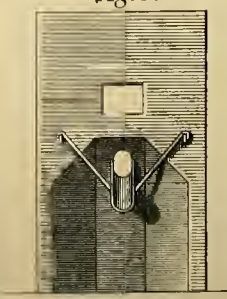


Fig.7.

W Johnson, Patent Offices,
47, Lincoln's Inn Fields & Glasgow.

INS. 12 6 0 1 2 3 4 5

SCALE. 10 15 20 FEET.

Mackay & Kirkwood Glasgow

ON THE FUSION OF STEEL IN GREAT MASSES.

Illustrated by Plate 297.

In the article on Steel in our January part, we gave a sketch of the past history and present position of this branch of manufacture. We pointed out that the great want awaiting solution, was the discovery of the means of melting steel in large masses at once, without deterioration of its quality; which being accomplished, steel must, with great rapidity, supersede, as castings, cast-iron, and in forgings, &c., all the forms nearly of wrought iron. Such a permutation of materials, is the great impending metallurgical fact of the day, and the future historian of the iron manufacture, there can be little doubt, will have to record changes, and expansions of application and of consequent power—to occur during the next quarter of a century—more striking than those that followed upon the use of hot blast, or, indeed, have marked any past epoch in the history of iron. We mentioned that the Emperor of the French, who has always shown himself alive to the powers latent in metallurgy, and wisely promoted their development—had devoted a large sum of money to experiments upon melting steel in reverberatory furnaces, which had been attended with success.

We are now in a position to give a sufficiently complete account of those experiments—of their principles, and of their results—accompanied by an engraving of the furnaces in which these fusions have been conducted.

The peculiar combination of iron with a very small percentage of carbon, which constitutes steel (all the other bodies present, even including nitrogen, as to which there has been latterly so much discussion, being merely accidental) is, at least, at high temperature, a body of extreme delicacy as to its chemical constitution, and susceptible of changes which, with great rapidity, alter its composition and impair its physical qualities for its useful purposes, when it is exposed to some of the volatile products of furnace combustion, or even to some of the solid materials employed in furnace construction. Sulphur evolved from pyritose coal, or even from the sulphates present in the mineral salts that enter into the composition of the plants that have mainly formed peat, oxidised more or less by burning these as fuels, is almost instantaneously deoxidised and taken up by liquid steel; and whether by expelling and replacing the combined carbon in part, or by the production of a wholly new ternary compound, its effects in destroying the valuable qualities of the steel are marked. Silicon is also readily taken up when presented in certain states, as are several of the metals (besides iron) found occasionally in the materials of furnaces or fuel, and generally produce steel, no longer readily workable.

The fusion of steel requires to be conducted, so that it shall be protected from direct contact with these injurious bodies, and until very recently no method was known to be successful in effecting this, but that of fusing the steel in crucibles. The temperature at which cast steel fuses—probably about 400° Fahrenheit above the welding heat of wrought iron—is so very high, that these crucibles can only be formed of the very finest refractory clays (or fire clays) of the coal measures, or from the very few other earthy materials found, of sufficient infusibility and abundance in nature. One of these is the peculiar material chiefly from Sweden, of which the wonderful fire bricks and crucibles of Messrs Vigen and Company of Westphalia are made, some of which were exhibited in the Zollverein at the late Exhibition, and in which, *per se*, a Stourbridge clay fire brick may, it is stated, be melted down.

Crucibles for cast steel are made of a nearly cylindrical form, with the lips around the brim turned a little inwards, both for increased strength and to diminish the aperture, and so reduce the accessibility to foreign bodies. They are heated in separate wind furnaces (generally), with good coke as fuel. From the action, at the high heat to which they are exposed, of the earthy salts contained in the coke and its ashes, of the bricks &c. of the furnace, and of the portions of oxidised steel that get outside the crucible in use, these crucibles get rapidly *thinned* down both inside and outside, but chiefly outside, and unequally so. The result is, that the handling of these crucibles, filled with melted steel, by the tongs, is always an operation full of peril to the workman. And these conditions, coupled with the large hydrostatic pressure of this dense material in fusion, have fixed the size of cast steel crucibles, which has been practically found to reach its higher limit at about 100 pounds capacity for fluid steel.

Each crucible, well made, of the more ordinary clays, stands from one or two to perhaps five meltings of the above weight on the average. The "Vigen crucibles" (which are more costly) are stated to stand from eight to twelve meltings. Window or bottle glass has long been employed under the name of a flux (in which capacity it no doubt acts, so far as the taking up the thin film of surface rust, that often exists on blister steel bars when broken up for melting, is concerned) but mainly as a liquid shield to protect the steel when liquified from the action of the injurious constituents of the fuel gases, eddying over it in the furnace, or from the oxidating air that passes through these furnaces of cutting draft. From the presence of this, and of the slags adherent to the exterior surface, the fragments of these old crucibles are only in small part capable of being ground up, to help in forming new ones. From all these circumstances, the cost of melting steel is great in relation to the weight fused, and has always, even in days when cast steel was a precious material for cutlery and tools &c. only, formed a heavy item in its first cost. But when cast steel began to be employed for other purposes, and in far larger masses, these evils were proportionally magnified. The difficulties and dangers, even with the best discipline and arrangements, attending the handling of several hundred crucibles, all requiring to be withdrawn rapidly from the furnaces, and in quick succession poured into one large ladle or mould, so that it should become filled so rapidly as to have no time for chilling, and to present, when the mass should be cold, an homogeneous fairly surfaced solid, and free from slag, &c., are very great; and although these may be overcome or disregarded, as the immense cast steel masses of Herr Krupp, shown at the late Exhibition, and cast in this way, proved, still the expense was great. In fact, at the rear of Krupp's works, at Essen, there may be seen, an almost mountainous heap of used up crucibles, the spoils of this highly primitive process, which has led the way in casting of steel in large masses. Numerous desultory attempts have been made, and by many persons, and some long anterior to our day, to manage to melt steel in a reverberatory furnace. The ordinary refinery furnace has been repeatedly tried, but the results have been uniformly unsuccessful; either the temperature of the furnace was insufficient for the complete liquifaction of the metal, or the furnace was itself destroyed by the high temperature, or the steel was destroyed by oxidating out its carbon, or by the introduction of injurious foreign bodies.

Yet the idea was a just one. Once let it be possible, to get rid of the diminutive crucible, and to melt steel in an air furnace, and we have reduced the time and cost of the process amazingly; and there are no longer any limits to the size, of the masses we may form with facility, and with the certainty of soundness.

This is the problem which Mons. Alfred Sudre, a French metallurgist, has solved, and which the Emperor has enabled him to prove, upon a large scale, at the expense of the Imperial Exchequer, at the iron works of Montataire, near Creil (in the department of Oise), and not far from Paris.

An extremely able memoir by the inventor, "*Sur les essais du procéde de fusion des aciers au four a reverbère executes aux forges de Montataire, du mois d' Octobre*, 1860, *au mois de Mars*, 1861, occupying nearly half a *Livraison* of the *Annales des Mines*, was published the latter end of last year, and along with it "The Succinct Report, upon these essays, made at Montataire, by the order and at the cost of His Majesty, the Emperor, and presented to His Majesty by M. M. Trouille de Beaulieu, Colonel of Artillery, Sainte Claire Deville, Maitre de Conférences a l'Ecole Normale, and Captain Caron, also of the French Artillery."

From two, at least, of these names, as well as from a sentence or two

of M. Sudre's—"*nous nous proposions de faire forger, avec les lingots obtenus, des noyaux ou ames de pieces de champagne du calibre de* 4"—we get an inkling of the views in the distance, that have fastened the Emperor's attention upon this particular discovery. He sees in it part of the "*avenir de l'Artillerie,*" that has so long engaged his mind, and of which he is so competent a judge. Nor shall we houour him a bit the less, tbat while thus intelligently promoting the industrial resources of the great country he governs, he has, primarily perhaps, in view, the exaltation of its military power;—we ourselves are trying to do the same sort of tbing, but, uufortunately, without the system, precisiou of thought, and economy of means, tbat the Emperor employs with such success.

The methods of M. Sudre appear to have been devised as early as 1857 or 1858, and have been patented in Great Britain, as well as abroad; the date of the British patent heing 31st December, 1858, (No. 3007) sealed 29th May, 1859; a commuuication to John Henry Johnson, London; and rather more than a year appears to have elapsed, before the inventor succeeded in arresting the attention of his own Government, so as to be enabled to commence his trials on a great scale in October, 1860. He had previously held a position upon the "Chemin du fer du Nord," and made experimental researches on the fusion of steel in its forges.

M. Sudre's discovery rests upon the combination of three distinct inventions or applications, viz., a method of constructing a reverberatory furnace, producing, with pit coal, a heat sufficient to melt cast steel, without destroying itself. A method of economising the heat of this furnace, by preliminarily heating the steel to be melted, near to its fusing temperature, without injury to its quality; and a method of protecting the steel, as soon as it is placed in the reverberatory furnace, from all injurious action of the gases, etc., passing above it, or otherwise, both hefore and after its fusion upon the hearth of the furnace.

Figs. 1, 2, and 3, plate 297, represent, in vertical, horizontal, and transverse sections, the form and dimensions of the reverberatory furnace employed by M. Sudre, in his first trials on a large scale. This furnace was perfectly successful; but experience in its use, and some suggestions due to the acuteness and science of M. Sainte Claire Deville, developed some points in which it might be improved, and resulted in the furnace shown in figs. 4 and 5, which is a longitudinal elevation and vertical sectiou of that adopted by M. Sudre in his latest operations It differs from the former only in proportions, and in some structural details, to which we shall allude hereafter. The furnace, it will be seen, consists of the usual grate of fire bars, separated by a bridge from the hearth. and that separated by a second and contracted bridge, from an oven, in which is placed a large muffle. or earthen retort. The flame from the fuel passing over the first bridge, and deflected hy the low arch above in the usual way upon the bollow of the hearth, passes on over the seeoud bridge, envelopes the muffle, and finally passes off, through a descending aud horizontal flue, to tbe chimney stalk—a damper heing interposed.

The chimney stalk at Montataire, into which the furnace drew, was about 85 feet in height, 5 feet square inside at the base, and 3 feet 8 inches square at top, and three or four puddling furnaces also worked into it, during these experiments.

The draft of M. Sudre's furnace, however, is not dependent wholly upon the ascensive power of the stalk, and this constitutes one of its main peculiarities. It is supplied by a forced blast from a fan, delivered into the closed ash pit. The fan employed was about 33 inches diameter, and 14 inches breadth of blade, and ran 1200 to 1500 revolutions per minute. The front of the ash pit is closed by a plate, removable for the purpose of getting out the asbes, after one or more fusions. The hearth of the furnace is so formed that the steel, when in fusion, can be tapped out, through a lateral aperture, openiug into tbe bottom of the hearth, provided with a moveable iron shoot lined with fire clay, hooked on to the peculiarly formed side plate of the furnace mouating, as seen in fig 4, and to eularged scale in front elevation and transverse section, in figs. 6 and 7. This is stopped by a plug of tempered infusible clay upon tbe end of the ordinary *bott stick*, such as is commonly used for the like purpose in iron foundry cupolas.

Great care and precaution were employed in the formation of the bottom of this heartb, whose capacity was tbat to contain nearly 1800 pounds of liquid steel, with sufficient room for flux, etc.

It was formed of one mass of very carefully beaten and tempered clay, formed in place to shape, over a layer of dry sand, covered with thin millboard on top, (which, when reduced to charcoal, was expected to leave perfect freedom of contraction to the sole of clay) the sand bed heing laid on courses of bricks on the flat. The material for the sole was formed of one-fourth tempered infusible clay of Andennes, worked up with great care, with three-fourths of like clay previously baked, and the masses reduced to powder, and sifted to fragments of about one-eightb inch in diameter. The object of all this care was to prevent the fluid steel from finding its way down below the sole of tbe hearth, or the latter heing acted on by the protecting flux employed.

In the second furnace employed, these precautions were in part neglected, and the sole was formed of fire hrick of the same clay, but, as it proved, with disadvantageous results; and the result of experience has caused M. Sudre to propose for his future furnaces, soles formed by the potter, in each a single piece of infusible clay, baked, and laid into place on a bed of sand. Tbe first experimental muffle was formed of fire hrick, but this was not found to answer; and a couple of earthen coal gas retorts, laid side by side, and supported on pillarets of bricks, so that the draft circulated beneath as well as around them, were substituted; these answered tolerably, though not sufficiently infusible, and found liable to crack, and so to let in air to oxidise the steel witbin.

M. Sudre in his last furnace employed such retorts, laid upon a solid sole of fire clay, and coated all over above, with a considerable thickness of the same, so that the flame, &c., only played above them—as seen in fig. 5.

In this furnace, too, he remedied some other inconveniences found in the first. Thus, for the fire clay *plugs* (*obturateurs*) in iron frames, with which the apertures of the first furnace were closed, and which were found to expand and stick fast, and even to get soldered into their nlaces—he subhstituted the ordinary slab of fire tile in a balanced sliding vertical frame, as usual in puddling furnaces, and the two bridges were made hollow, the air spaces through each passing right out througb each of the side walls of tbe furnace, so that any cracking or escape of steel here, could be at once seen, and guarded against by ramming in dry sand into the air spaces, the ends of which are seen in figs. 4 and 5.

The main other difference of this second furnace from the first, consists in the lengthening the whole considerably. This was due to M. Sainte Claire Deville, who remarked with the first, that the point of greatest heat was beyond the second bridge. It is indeed obvious, that a reverberatory furnace with a forced draft, must have this point "*le coup de chalameau*" thrown further forward beyond the bridge, as the draft is stronger.

The dimensions of every part of these furnaces, the special precautions adopted by him in every detail, the results obtained, even the accidents and mistakes and tentatives through which this, like every other great improvement, has passed, are minutely recorded by M. Sudre, with honesty and intelligence, iu his valuable memoir; but, to the original, we must refer those who take a direct interest in the subject, as occupying too much space here to transcribe.

We pass therefore to some explanations of the principles upon which his methods are based. It has been known since the researches of Dr Robinson's (of Armagh) early years, to be found in the Transactions of the Royal Irish Academy, that as high a heat can be produced by a draft furnace, as by one urged by blast; that the only difference as regards the maximum temperature attainable, is *one of time*. The blast furnace arrives within a few minutes, at a temperature that the draft or wind furnace may take hours or days to attain. But upon this question of *time* depends, *cæteris paribus* that of the endurance of the furnace itself; whether in fact, if the heat be sufficient, the matter exposed within the furnace, be alone melted, or with it, or before it, the furnace itself be melted down.

It was by proving and taking advantage of this truth, that Dr Robinson was able quite thirty years ago, to fuse platina in a small blast furnace, using as fuel the pure hard anthracite of the Kilkenny coal field; and with whicb he attained a temperature that certainly has never since been exceeded with auy solid fuel. It is true that, as Dr Wollaston (who was present at some of these trials) showed, tbe magnesia of the crucible acted slightly on the platina, to produce an alloy more fusible, than pure platina itself.

This then is the first object of M. Sudre's ingenious combination. By applying forced blast, to an air furnace with the reverheratory hearth, he is enabled, after bringing up by *air droft only*, the heat of the whole furnace as high as its materials will safely bear, then, at the right moment, by converting the natural draft into a forced blast, he can within tbe shortest possible time—and therefore with the least possible injury by melting of his furnace—briug it up to the extremity of heat necessary to bring the steel into fusion. But further, the steel itself, must be brought to such a preliminary state of high temperature, that it shall offer the minimum of resistance to the fusing power of the furnace thus urged to its highest point; in other words, cold steel must not be put into the hearth of the furnace, but steel that has been *already heated* up to tbe highest point at which it can be handled with safety, and freedom from any serious amount of oxydation during the moments of transfer. With this view, he employs the waste heat of his furnace to heat the muffle, in which close oven heated all around, but having no commuuication with the interior of the furnace, the cold steel is placed, surrounded more or less by grossly powdered charcoal, which deprives of oxygen any little air that may find entrance, while the faggots or pieces are gradually and thus safely, from chemical change, becoming heated up.

But the steel thus brought to a brigbt red or even yellow heat, when thrown into the hearth of the furnace to be finally liquified, must still be protected from the evil effects of direct contact with the gases, &c. of the fuel. The means by which this is effected, constitutes the third of the methods, which combined, constitute M. Sudre's inveution.

While certain bi-silicates or silicates, such as tbose of the refinery

hearth for example, exercise a chemical solvent power of amazing energy upon clay compounds, such as fire-brick, &c., it is well knowu that neutral or basic silicates are almost devoid of any such power. Thus, glass of various constitutions, may be kept in a fused state for weeks, and at the high temperature of the glass house furnace, in the Stonrbridge (or other like) clay, melting pots, without any serious erosion of the latter taking place.

These basic or neutral silicates (of earthy hases) have no action whatever upon metallic iron or steel, at the fusing temperature of the latter, although they dissolve and take up whatever oxide of iron may be adherent to the surfaces of the metallic masses exposed to them. In brief then. M. Sudre fills, to a certain point, the hearth of his furnace, with broken wiue bottle glass, or with slag from blast furnaces smelting iron with charcoal fuel, or failing the possession of either of these, with about 60 parts flint or pure siliceous sand, 22 parts of lime, and 12 to 15 parts of alumina (pipe clay), and brings these into perfect fusion.

Into this bath of fluid glass, the pieces of steel, removed with tongs from the muffle, and already heated to a yellow heat, are plunged upon the hearth of the furnace. The steel being of higher density sinks to the hottom of the glass, by which it is thus completely prevented from all chemical action of the gases of the furnace—while with nothing hut a stratum of an inch or two of liquid glass between, it is freely exposed to its heating power. Within the limits of time, during which the steel is here exposed, the silex of the glass will no doubt have no perceptible action upon it. We may mention, however, that iron exposed for *very long* periods, in preseuce of common window glass (crown glass,) becomes strongly *siliciuretted.* The writer found, some years ago, that pieces broken or dropped, off the ends of the iron blow pipes in Mr Coathupe's works at Bristol, and which had remained for months in the bottom of the glass pots, were converted into globular masses, harder than any file, with a high silvery metallic lustre, and upon analysis proved to contain a definite compound of silicon and iron.

To each 1000 pounds of steel he finds it necessary to have about 700 pounds of liquid glass upon the sole of the hearth for complete protection. The glass gets *partially* devitrified, even in a single fusion, but, as in Paris, the price of broken wiue hottles is only about twenty shillings per ton, a new supply is not a large item in the expense of the process.

French bottle glass, like our own, differs much in composition, hut all samples approximate to the formula,

$$K\,O + 8\,Ca\,O + 2\,Al_2\,O_3 + Fe_2\,O_3 + 8\,Si_2\,O_3.$$

Onr English hottle glass is frequently made with crude soda, or with Glauber's salts, from the salt cake works, in part at least, and so may not be free from sulphur componnds, which might injuriously act upon the steel. M. Sudre gives his own preference to the French hottle glass, bnt has also employed with success, the slag from the high furnaces of the Couvin iron works, in Belgium, the iron of which, produced by charcoal, is justly celebrated. The coal which he actually employed in his experiments, and of which he appears to have burnt in all, something like 50 tons, was of very inferior quality, and very ashy.

He remarks that the glass of the enveloping bath, after the fusion of the steel, had acquired certain hands and stripes of alternate green and blue, which he says, had some resemblance to malachite and to ultramarine, but it does not appear to have struck him that this hlue handing, (like the intense blue opaqne slags, sometimes met with in Staffordshire, and which we have ourselves proved to he artificial ultramarine, accidentally formed in the hlast furnace), is no douht due to the actual presence here of ultramarine; and bearing in mind the nature of Guimet's process for its manufacture, this affords absolute proof of the effective protection which the liquid glass affords to the fluid steel beneath, from the sulphur compounds floating above them.

The results of M. Sndre's experiments, at Montataire, have heen to show incontestibly, that steel may be thns fused in masses of almost any magnitnde, free from deterioration, and that his process is practicable in all respects, capable of heing carried on, day hy day, in a manufacturing manner, and with an economy far greater than is possible in crucible operations, on equal weights of metal.

The consumption of coal, (of such quality as he had,) was about 2 pounds for each pound of steel melted, and the total loss of steel in the process varied from about 8 down to less than 5 per cent. Such preliminary trials however, are no test as to the amount of loss, which must always, in snch, be excessive. The process, when systematized, would probably not reach 3 per cent. of loss in actual work.

The steel employed for these experiments, (probahly for economy sake,) consisted, in great part, of old files broken up.

These apparently, from the large amount of surface rust, and from the teeth being more or less filled with minute particles of hrass and copper, or other metals perhaps, do not appear to have given very good results, as to the quality of the steel after fusion into large ingots. Puddled steel, however, both of French make, and from Ynstalyfera, in South-Wales, made from anthracite iron, was also fused. And amongst the ingots ohtained, pieces sent to the *Musee de l'Artillery* at Paris, were wrought into fine cutlery tools, and tested in various ways, and found to be of excellent quality.

M. Sudre's results actually lead to a financial result, of a ton of steel melted at a total cost of about 58 francs; but we do not think it quite fair to fix upon this, so candidly given by him, as at all the minimum to which his process will eventually come.

He thus sums up the comparative financial statement of his own method, and of the old one of crucihle fusion. M. Sudre's process produces an economy of about two-sevenths the fuel, which will, no doubt, hereafter be pushed still further.

The cost of crucihles is wholly got rid of, which amounts to ahout 30 francs per ton of steel.

The cost of keepiug in repair the reverberatory furnace is not more than one-third that of the crucihle wind furnaces for equal weights fused. Four-fifths of the manual labour employed in the crucible operations are saved—in the case of common sized cast steel ingots, viz., of from 50 to 100 pounds each; but in the case of such gigantic ingots, as those produced hy Krupp by his method of multiple pouring from crucibles, it is impossible to say what saving may be effected—probably, more nearly nine-tenths of the whole.

The outlay in plant for fusing equal weights in equal times hy this mode is estimated, by M. Sudre, as two-thirds less than with crucible furnaces.

In addition to these, as we helicve, perfectly well estahlished financial results, we have the simplification and facility of manufacture, and the perfect safcty of the workmen insured, as compared with crucible work.

The form of the ingot moulds, adopted by M. Sudre for his experiments, are shown in elevation and plan in figs. 8, 9, and 10 of our plate. The latter was intended for gun moulds, but he shows good reasons for ahandoning round, i.e., cylindrical ingots for every purpose, and adopting those of the unequal sided octagon instead. These reasons are related to the subsequent processes of hammering, and have been anticipated by Nasmith, Mallet, Clay, and others in this country. The metbod of pouring or transferring the steel from the hearth of the furnace to the ingot mould, adopted by M. Sudre, consisted in tapping out the metal, iuto a crane ladle, lined with more than usually refractory clay, and previously strongly heated.

In the bottom of the ladle was a hole, stopped by a conical plug or valve of haked clay, on the end of a vertical iron stem, rising above the surface of the liquid steel, by raisiug which, the jet of metal flowed vertically and directly into the ingot mould.

This method, called in France the "*coulée á la quenouille,*" i.e., literally *by the distaff,* which the clay plug resembles, has been often employed in our iron foundries, and is that employed by M. Bessemer for pouring the steel made by his patent process.

M. Sudre, we observe, claims, in his English patent, the exclusive right to the re-melting of steel made by the Bessemer process. Should the Bessemer steel continue to improve in quality, and in certainty of result, as we fully anticipate it will, probably all great masses, such as gun moulds, etc., will he run direct from his converting vessels; and, in so far, M. Sudre's process will be needless, but its value and importance, in re-melting steel, and in many future branches of iron metallurgy, that as yet only dimly show themselves in perspective, will not be superseded.

Four to five hours, from first charging into the hearth, was fouud sufficient time to hring into perfect liquidity, 600 or 800 kilogrammes of steel. When we recollect that the furnace was fed with *cold air,* that the coal was of had quality, and that the whole affair was novel, and the brick work of the furnaces and flues, in all the latter experiments, soaked in wet, from the overflow of the Seine river in flood, we see that this short time, can still be greatly curtailed hereafter. The employment of *hot blast* is provided for by M. Sudre in his specification, and its use will, no doubt, greatly advance all the objects of his method. We believe he might also greatly improve his method, or, at least, still further exalt the temperature, and reduce the time, of action of his furnace, by employing for fuel, *at the last stage* of the process, pure anthracite coal of the hardest quality, such as that of Kilkenny, already brought into ignition in a separate fire place; and devising means by which it should he fed into the grate of the reverberatory furnace, in measured bulks, without ever opening any aperture to the external air. For, although with the fan blast, the rush of flame is *outwards* and cold air is not introduced, the regimen of the flame at its point of maximum intensity is thus, for the moment of feeding with fresh fuel, constantly disturhed and the heat lowered. One immeuse advantage of such anthracite as we above refer to, is also that it produces literally almost no clinker to choke the bars—and this is the point in M. Sudre's invention which in practice we are disposed to think will be the most troublesome, to feel one's way to perfection with.

As this method becomes employed, it must give rise to a demand for fire bricks and moulded blocks, of various large sizes and forms, for building these furnaces, of a far higher quality, and much more refractory, than anything at present in the English fire brick market. In

these we have much to learn from Germany, where crucibles (*tiegel*), bricks, and all forms of fire blocks, &c., are made of a quality and infusibility that we have not yet attained to. M. Sudre well remarks, that the *larger* the *blocks* of which his furnaces shall be built, the longer and better they will stand the severe action of the fuel, &c.; and he advises coal to be employed, that shall not contain more than 3 per cent. of ashes.

The statements made by M. Sudre in this remarkable memoir, are fully borne out by the report of the three Commissioners of the Emperor, who were present at several of the experiments. They state that it has been proved satisfactorily, that thus a mass of upwards of two tons of steel may be fused, without any injury to its qualities, and with remarkable economy and facility. Two tons is yet a long way behind Krupp's—20 tons ingot; but there is no reason why 20 or 50 tons should not be thus melted, in one or more furnaces.

This invention must promote powerfully the much needed abolition of wrought iron in paddle shafts, cranks, screw shafts, &c. Why should not all our propeller screws, too, be now cast in steel at once, in place of making them of gun metal, at an enormous cost, and to the destruction by corrosion, of their own shaft necks, and of all the iron of the ship around them.

The day, too, of wrought iron artillery ought soon to end; small guns, all up probably to 32 pounders may be cast, and forged, and finished solid; but although M. Sudre's methods give the means of casting, and afterwards forging in *one mass*, guns enormously larger than even Krupp has done, it will be most unwise to turn back, from that ringed structure with initial tension which alone can give the maximum strength from a given weight of metal.

What these improvements in steel point towards, as respects the heaviest classes of artillery is this, that *welding*, as well as wrought iron, with which it is inseparably connected, should be abandoned. That every separate piece and ring, of a gun, whether Armstrong or any other, *should be produced from the liquid state in a single united mass*, and that thus, while on the one hand the uncertainty of welded unions is got rid of; we substitute in the change, for a material of about 30 tons breaking weight, one of from 70 to 90 tons per square inch.—Ed.

THE ROTATORY DISC BLOWING MACHINES.

By Mons. M. E. Fossey.

Illustrated by Plate 295.

The application of the steam engine to producing blast has not been yet given at all the careful theoretic and practical attention, the importance of the subject demands.

Blowing engines may, with unimportant exceptions, be divided into four classes—those of the *Trompe* class, in part dependent on like principles with Giffard's Injector; those dependent on centrifugal machinery, fans, etc.; those acting through displacement of air by a body of water; and those of direct mechanical compression, bellows, blast cylinders, chests, etc. With the latter alone we are here concerned.

Perhaps the most singular example of rude and primitive, but most ingenious blowing apparatus, is that of the bellows formed of *dried leaves* stitched together, or sometimes only stuck together with lac, employed by some of the hill tribes of India, examples of which were shown in the Exhibition of 1851.

Blast chests of wood, of rectangular section, with *pistons* worked horizontally and alternately by hand, are figured by Agricola (*De re metallica*) who died in 1555, but we must pass over the archæology.

The earliest blast cylinders directly worked by steam power were constructed in Scotland and England by Smeaton, Roebuck, and others, about 1780-1790. The engine was the single acting atmospheric of Newcomen; and in the first constructions the blast cylinder was an open topped forcing pump, with a heavily loaded piston without apertures. The inlet and outlet valves were hinged, and at the bottom of the cylinders. The indoors stroke of the engine lifted the loaded piston, which, being then released, descended, compressing and ejecting the air below it, and bringing the engine out of doors ready for next stroke.

The next advance consisted in turning the cylinder upside down—leaving the bottom end still open—passing the piston rod up through a stuffing box in the closed upper end, and forming the inlet valves in the piston (opening upwards), and the outlet valves in the air main leading from the cylinder top. By this means the indoor stroke of the engine did the work of blowing directly, the return stroke being given by a just sufficient preponderance in the blast cylinder piston end.

The regulation as to approximate constancy of the blast was, in both cases, produced by a "regulating cylinder" with a floating piston, properly loaded, and confined in range by powerful check beams of timber; the details of all which have been given by Dr Robison in his Treatise on Pneumatics, and by Farey in his work on the Steam Engine.

It was not in fact until 1796 that the pretty obvious notion that an elastic fluid might be made to regulate itself as to constancy, by intermittent pumping into a mere close vessel, or air-chamber of sufficiently large size; and this seems to have been first carried out by Dr Roebuck, at the Devon Iron Works in Scotland.

From the data given by Smeaton and Farey as to these early blast engines, it may be computed that their duty amounted to no more than about 207 cubic feet of air at three pounds pressure per square inch blown per minute, by the consumption of one pound of coal. Most of this deficient effect, however, was attributable to the imperfection of the engine, which burnt from seventeen to twenty pounds of coal per horse power per hour; for, apart from any question of loss by large leakage due to slow movement of piston, we are disposed to believe that the compression and ejection of air by the free descent of a loaded piston, offers positive theoretic advantages.

In 1777, Watt constructed, for Wilkinson, in Lancashire, a single acting engine, which worked a double acting blast cylinder at the opposite end of the beam—the stroke in one direction being made by preponderance. This seems to have been the first double acting blast cylinder. It was not, however, until about 1805-7 that he applied the double acting beam engine, to the double acting blast cylinder. This engine had a forty-eight inch cylinder, and actuated a blast cylinder of eighty-four inches diameter—the stroke of either being eight feet.

The consumption of coal is not given, but assuming it to have been ten pounds per hour per horse power, the data afforded by Farey enable us to compute that about 407 cubic feet of air at three pounds pressure per square inch was delivered by the consumption of one pound of coal. Now, as it has been shown that more than fifty per cent. of the total steam employed, was wasted in the atmospheric engine, the comparison of the preceding results shows that, as regards the blowing apparatus itself, there was probably some theoretic advantage, as to return in duty, of the single stroke blast cylinder by descent of the loaded piston, over that of the double stroke constantly impelled.

An early, and by no means bad example, of blowing apparatus was that constructed (we believe) at Soho, for the forges of Woolwich dockyard; it consisted of three single acting cylinders, with a regulator. The pistons were driven by a three throw crank, the stroke being increased in length by vibrating beams fixed at one end, the piston rods at the other, and the connecting rods between; and the inlet and outlet valves were all slides, with mechanical action independent of the effect of the air.

The great defect of all low pressure condensing blast engines is, that as the maximum available force, per unit of piston's surface, is constant, the dimensions of the engine, and of the blast cylinder dependent upon it, limit the volume and the density of the blast to a point beyond which they cannot pass. This evil is got rid of by the employment of the high pressure engine, which, if only proportioned strong enough, and its steam passages made large enough, may be driven both at a higher pressure, and at a greater velocity, and so, both the pressure and the volume of the blast be increased when demanded.

This, and occasional difficulties of position, such as want of water for condensation, seem to have first given rise to the application of high pressure steam to blast engines, which has now become so common. Examples are not uncommon, both in England and abroad, of beam engines, with vertical cylinders, of this class; but the tendency on the Continent, especially, has been, in this, as in almost every other application of steam power, to run upon the horizontal construction of coupled engines.

For blast cylinders of small, or at all moderate size, the horizontal high pressure construction offers many important advantages. The outlay for foundation, and for every part of the machine, are reduced; and while, with vertical beam engines of condensation, a piston speed, in the blast cylinder, of 300 feet per min. is a high velocity, it may be carried up to 600, or even more, in the high pressure engine, unhampered by the inertia of beams and other heavy reciprocatory organs. Every blast engine should be constructed, not only of the very best materials and workmanship, but with a great margin in excess of strength. Its function is to continue in work, without cessation, as long as a furnace is in blast; that is to say, it ought to be capable of working, with only a few minutes' stoppage, once a-week or so, for months and years, not needing a stoppage, for repairs of wear and tear, oftener than once in two years, and then for not more than thirty-six or forty-eight hours. A blast engine, to be really efficient, ought, therefore, to be constructed with all the precaution, and regard to prevention of accident, that characterises the best examples of marine engines; such is, with few exceptions, very far from being found the fact, however.

The rapid piston speed of the horizontal high pressure blast cylinder is attended with a notable reduction of leakage past the piston, and with greater steadiness in the blast itself. This cannot, however, be pushed too far; the air is always, more or less, heated by its compression; the amount of mechanical labour that thus becomes converted into heat, however, is greater, with a given final reduction in volume, as the compression is more sudden; and although the heat so evolved

is not wasted, being returned partly, in effect in the furnace, yet, a perceptible reduction in duty begins to be perceived when the piston speed approaches 500 to 550 feet per minute. The writer, some years since, designed and constructed, for the cupolas of a large foundry, a pair of double acting blast cylinders, each of 36 inches diameter, with 36 inch stroke, worked by cranks at right angles, and driven by gear, so that the speed could be modified. At 60 to 70 strokes per minute, these cylinders, without any regulator beyond a very large sized and pretty long air main, acted admirably; and with a cupola of about 48 inches diameter at the tuyers, melted down more than three tons of iron per hour with ease—the pressure of the blast being large; but, when the speed was run up to 80 to 90 strokes per minute, the increased absorption of power was enormous, the yield of fluid iron was not materially increased, and the heat developed from the friction of the pistons and cylinders, and from the compression of the air, and shutting of the valves, etc., was such that no care could prevent the roaring vibration, before referred to as "didthering," from taking place, and endangering the whole train of machinery. Had these cylinders been horizontal, they could not have been worked, small as they were, even at the first velocity. But when the cylinders are very large, the weight of the piston becomes so great, that even with much stiffer rods than are usually employed, it bears so hard upon the lower side of the cylinders, as not only thus to vibrate, but to wear the cylinder very seriously.

We have ourselves seen horizontal blast cylinders of 85 inches diameter satisfactorily at work in Germany, but the speed was not more than about 360 feet per minute, and the engine had not been very long at work. From the constant introduction of dust, &c., the wear of blast cylinders and pistons is extremely rapid. From some data collected by us, we are disposed to conclude that large horizontal blast cylinders of average goodness of cast iron will not generally work through more than about 80 to 100 millions of feet of piston traverse, without reboring, even with the best care, and this seems to coincide with the observations of Mr Truran and other authors on the practical metallurgy of iron.

The valves of foreign horizontal blast cylinders are very usually made of vulcanized india-rubber, shutting upon metallic grids to divide the bearing strain. These work very silently, and admit of a large total valve area—both for inlet and outlet—both of which can never be too large, but these india-rubber valves, oppose more resistance to the air passages, by the force requisite for flexure, than one is prepared to expect.

Hinged, hanging, or clap-valves have, undoubtedly, the serious disadvantage, if the action be rapid, of almost always shutting with a severe blow and shock; and one of the evils of this, is the keeping the air of the house, in a perpetual cloud of dust, and so increasing, the wear and tear of everything. As very usually made of doubled leather, fortified with cross straps of iron—such valves, even when shutting hardest, last a long time. When the beat is so fast, as in the pair of foundry cylinders, to which we have already referred however, scarcely anything can be got to stand the sharp and rapid hammering that the valves sustain.

The writer found in that instance, that the best material for the valves consisted in a facing of cat-skin fur, secured by a thin coat of marine glue upon thick leather, and backed by two or three thicknesses of the best and hardest rolled millboard, also glued together with marine glue, and strapped across with light iron straps screwed with wood screws into the substance of the millboard. Valves so made, stood at 50 to 60 strokes per minute for months. Were he now to design any blast cylinder, however, he would certainly employ the method, of mechanically opened and shut valves—probably on some modification of the balanced slide, or the Cornish double-seat valve, in preference to any other. By such means perfect silence, and freedom from all shocks—a *less waste of power* by far, than by any valves directly opened by the air, and the procuring of the largest possible air ways, are all secured. These have, no doubt, been the aims, and the legitimate aims of M. Fossey's improvement, but we think they may be otherwise more simply and better carried out.

Hemp-packed pistons, after a time, work very well, dry, in blast cylinders. Leather-packed pistons, with reversed cups, we have ourselves not found to work pleasantly, and to wear through in patches, unless the cylinder be kept in a slime, of tallow and black-lead, and so forth. We have known of one instance in which a piston, formed simply of a turned ring or plug of rather soft mahogany, built up in plies, worked well, and with smoothness and stability for several years in a vertical cylinder, which it was turned to drop into loosely from the first. Metallic pistons do not seem suitable unless made upon some special design, and so as not only to *be* very light, which is scarcely practicable, but to press very lightly against the sides of the cylinder.

We have had described to us a blast cylinder piston in use in France, consisting simply of a flat plate, with a sort of piston cup, consisting of an L sectioned ring of thin sheet *brass*, made in six or eight segments in its circumference, and screwed to the plate, one above and one below. The elastic brass ring springs out slightly at each change of stroke, so as gently to press against the cylinder, and make it practically air-tight.

We think an excellent piston might be made on this plan, assuming the first requisite of every blast cylinder—namely, that it is of the finest grained, silvery, hard cast iron, perfectly bored, and smooth even to a polish.

Mr Truran, we remark, as the results of his practice, gives, upon the whole, a preference to vertical blast cylinders when of great size. Upon the whole, probably the *beau ideal* of a large blast cylinder would be a vertical one, driven by direct acting high-pressure engine from beneath, with piston rod, &c., balanced, and inlet and outlet valves, equal to half the area of the cylinder, and actuated mechanically, so as to open at once to their full area, at the change of stroke.

Such a form arranged in triplet, to work at 120° apart, would, perhaps, be as near perfection as possible.

A great deal of theoretic investigation based on experiment, however, is yet to ask for—from such men as Rankine or W. Thomson—as to what velocity of piston shall give the best result, and whether this velocity should be uniform or accelerative.

In commending this to our mixed mathematicians, to whom thermodynamics, with which it is so intimately concerned, are a special study, we may indicate how much room for improvement there is by stating that, while Smeatons and Watt's ancient blast engines, gave a duty as above stated, of from 200 to 400 cubic feet of air at 3 lbs. pressure from a pound of coal, the mean corresponding duty now of a considerable number of low pressure condensing blast engines in various parts of England, Scotland, and South Wales, does not appear to be more than from 500 to 550.

And while the mean of all the data that we are ourselves in possession of, does not give a duty for horizontal high pressure blast engines, now working, of more than from 500 to 550 cubic feet per minute, at 3 lbs. pressure per pound of coal, the corresponding duty from vertical high pressure blast engines appears to reach from nearly 900 to as much as 1370 cubic feet.

The largest engines and cylinders almost always appear to give the best results; but there are remarkable exceptions to this.

Although the data as yet collected, are scarcely sufficient to enable such an analysis of the phenomena to be made, as should distinctly point out the conditions of defect of complete efficiency, these are enough to guide to a great improvement upon existing practice, and to show that a great deal of the lost duty is not through defect of the engine, but in malconstruction, and unfit movement and velocity, in the blast cylinder itself.

M. Truran conducted a valuable train of experiments at Dowlais Works, to ascertain the power *uselessly* consumed in blast engines. The mean results of eight engines, both condensing and high pressure, showed that but 86·4 per cent. of the power acting *in the* engine cylinder was realized *out of* the blast cylinder. The difference, 13·6 per cent., represents friction, and other, more or less inevitable, useless work in the engine; and loss of effect as regards the treatment of the air in the blast cylinder. Now, we know the useless work of friction need not exceed 3 to 4 per cent., and in these Dowlais engines, probably did not reach double that amount, or say 7 per cent.; there remains, therefore, nearly 7 per cent. more of the total power consumed wasted in the blast cylinder part of the apparatus.—Ed.

THE PORTABLE ENGINE—PAST, PRESENT, AND FUTURE.

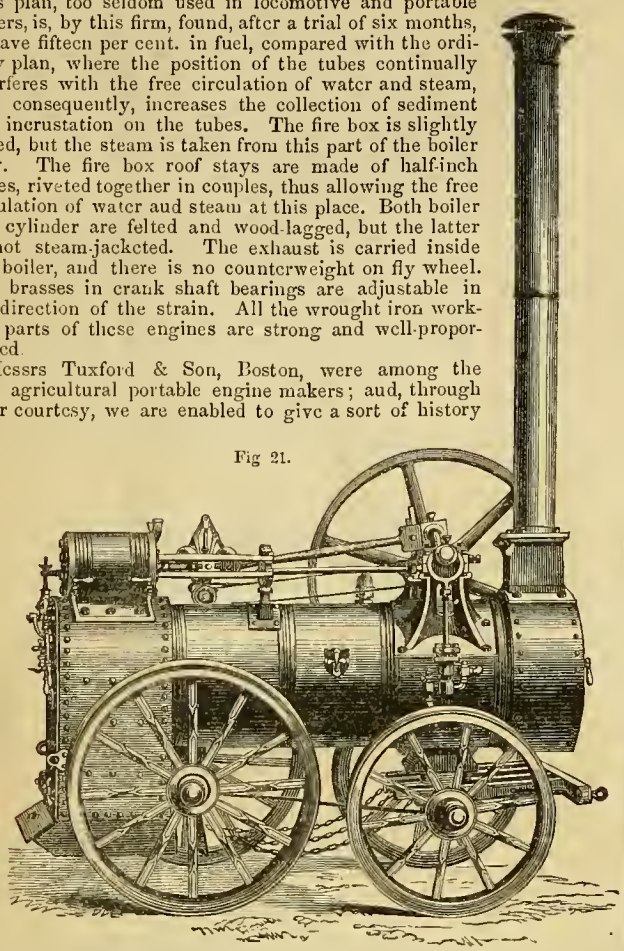
PART III.

In fig. 21 is given a side elevation of an 8 horse-power single cylinder portable engine, by Messrs Ruston & Proctor, of Lincoln; and in fig. 22 is given a similar view of a 10 horse-power double cylinder engine of the same makers. This firm is well-known for strong and simple constructions. Their first portable engine was made in 1845; the boiler was made with parted flues and return tubes; the piston rod was guided at its outer end beyond the crosshead, and motion transmitted to the crank shaft by means of a long forked connecting rod. The feed pump was fixed to the side of the cylinder, and worked directly from the crosshead. After this, some engines were made with a countershaft, with spur wheel and pinion to increase the speed. The old plan, however, with the exception of the boiler, which was made direct multi tubular, was returned to, and continued to the year 1855, when several improvements were made, which brought the engine up to the present standard of the best portable engines. The boiler and cylinder were both increased in size; and wrought iron double square guide bars were substituted for the old plan. The pump was made to be worked by an eccentric directly under the crank shaft, which latter had the crank inside the bearings; the slide eccentric was, by a simple contrivance, fixed on the shaft in such a way that its position could be easily adjusted and reversed. Shortly after this, a new plan of distributing the tubes in the boiler was resorted to, viz., placing them in rows parallel vertically, but in zigzag horizontally, to allow the steam to pass uninterrupted by the tubes up to the surface of the water,

at the same time allowing the sediment to fall down to the bottom. This plan, too seldom used in locomotive and portable boilers, is, by this firm, found, after a trial of six months, to save fifteen per cent. in fuel, compared with the ordinary plan, where the position of the tubes continually interferes with the free circulation of water and steam, and, consequently, increases the collection of sediment and incrustation on the tubes. The fire box is slightly raised, but the steam is taken from this part of the boiler only. The fire box roof stays are made of half-inch plates, riveted together in couples, thus allowing the free circulation of water and steam at this place. Both boiler and cylinder are felted and wood-lagged, but the latter is not steam-jacketed. The exhaust is carried inside the boiler, and there is no counterweight on fly wheel. The brasses in crank shaft bearings are adjustable in the direction of the strain. All the wrought iron working parts of these engines are strong and well-proportioned.

Messrs Tuxford & Son, Boston, were among the first agricultural portable engine makers; and, through their courtesy, we are enabled to give a sort of history

Fig 21.



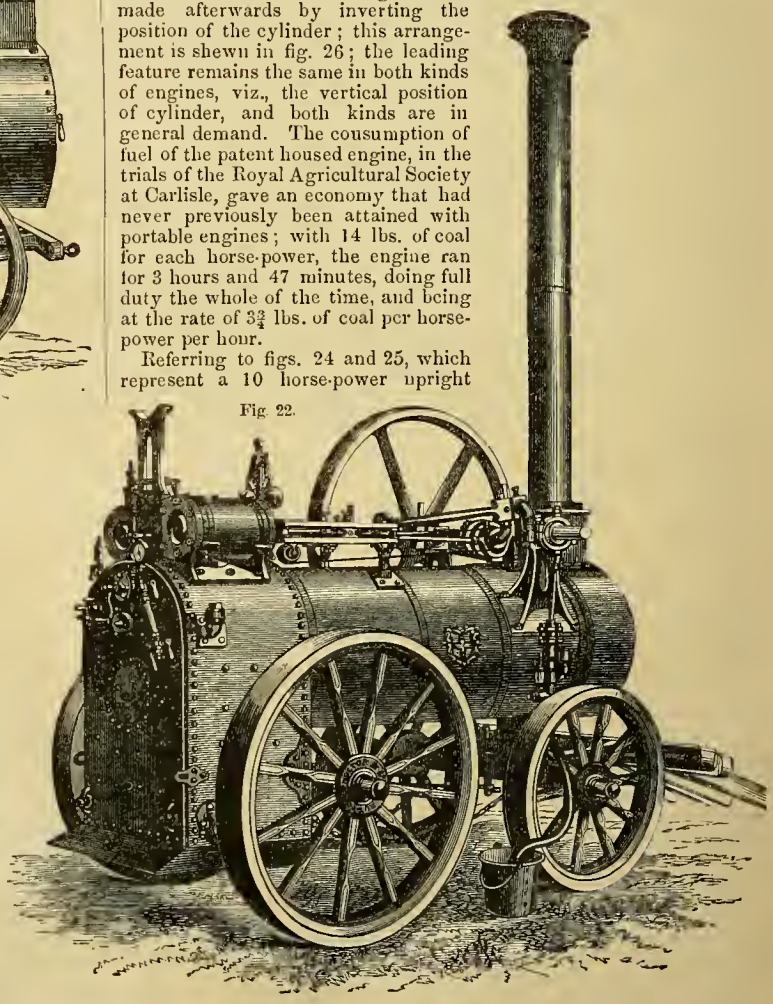
of these engines, in connection with the part they took in the introduction of the same. Prior to the time when portable steam engines were successfully introduced for agricultural purposes, various arrangements had been resorted to for giving portability to steam engines, when employed as a motive power in the place of the fixed engine. As far back as 1816, we find the name of Joseph Reynolds, patentee, for applying steam to carriages and to agricultural machines; his patent specification, No. 3973, embraces a large drawing of his engine, which was, besides driving machinery, to propel itself. Various arrangements were shown by Reynolds, which, in after years, were again patented, in some cases more than once—such as the employment of the castor wheels for steerage, and separate gearing to each of the impelling wheels, for causing the engine to rotate in a very small circle. Later than this, in 1837, John Upton, patented a portable engine, applicable to agricultural machines—No. 7458. Small engines, with upright boilers, having vertical cylinders standing on the foundation plates, and mounted on four small wheels, for contractor's purposes, were manufactured and advertised by Mr Gough of Manchester; but the agricultural portable steam engine, in its truly useful and practical form, must be considered to date from 1841. In that year, the Messrs Tuxford & Sons, of Boston, Lincolnshire, commenced receiving orders for their steam thrashing machines, the plans and models for which they had matured at an earlier period; and, early in 1842, it seems that the first steam thrashing machine was launched into general use, the purchaser being a Mr Roslin, of Sutterton, near Boston. Roslin's engine gradually worked its way many miles from Sutterton, first into Northamptonshire, then into Norfolk and Cambridgeshire; and, after thrashing upwards of thirty thousand quarters of grain, was sold to a landed proprietor in Cambridgeshire, the Rev. Mr Linton. Within the first nine months, the Messrs Tuxford sold fourteen of these engines; their success may, therefore, be considered as complete.

The illustration marked fig. 23 is a correct sketch of the first portable steam engine, with thrashing machine attached. The boiler had return flues, with water spaces in it; the fire box was within the boiler, and was surrounded by water, precisely similar to what Messrs Robey and Scott, of Lincoln, patented years afterwards; the chimney was jointed, so that a portion of it could lie down; the cylinder was horizontal oscillating. On the crank shaft was keyed a bevel wheel, into which a pinion geared; this pinion being on an intermediate shaft, which also carried the fly wheel and a spur wheel—the fly wheel was placed between the end of the boiler and the thrashing machine, and the spur wheel worked into the drum pinion. The thrashing machine was of the general construction then in use, and was similar to those employed with horse machines. The total length of a 6 horse engine, with machine attached, including the elbow bend of the chimney, was 11 feet, and the weight 3 tons.

Next followed the detaching of the thrashing machine from the engine frame work, in consequence of the introduction of the combined thrashing machines; and where the machine had stood was introduced a table engine with vertical cylinders; tubular boilers were introduced, and afterwards followed the patent housed engine, with vertical cylinder, and boilers with flues and tubes combined. At the Great Exhibition in 1851, this last kind of engine had a prize awarded to it; and the French Government obtained one for experiments in the Museum of Arts and Trades at Paris. The following illustrations, figs. 24 and 25, shows this engine in perspective and section elevation respectively. A modification of this engine was made afterwards by inverting the position of the cylinder; this arrangement is shewn in fig. 26; the leading feature remains the same in both kinds of engines, viz., the vertical position of cylinder, and both kinds are in general demand. The consumption of fuel of the patent housed engine, in the trials of the Royal Agricultural Society at Carlisle, gave an economy that had never previously been attained with portable engines; with 14 lbs. of coal for each horse-power, the engine ran for 3 hours and 47 minutes, doing full duty the whole of the time, and being at the rate of $3\frac{3}{4}$ lbs. of coal per horse-power per hour.

Referring to figs. 24 and 25, which represent a 10 horse-power upright

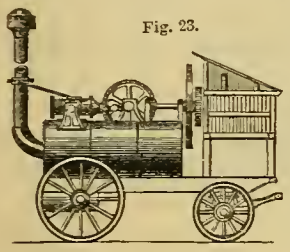
Fig 22.



cylinder steeple engine, enclosed in an iron casing attached to the back uptake of the boiler, which is made with parted flues and return tubes, it may here be remarked, that the vertical cylinder has an advantage over the horizontal arrangement, in the circumstance that the former is not liable to wear oval like the latter. This is a very good specimen

of a steeple engine, all parts being strong and well proportioned; the steeple construction admits of a long connecting rod without great height. Fig. 25 is a longitudinal vertical section of this engine, upon a wooden frame and wheels, and shows the interior of boiler and arrangement of the engine attached. There is an objection to the way the feed pump is worked from one side of the crosshead, thus giving a slight side pull to the same. Fig. 27 shows the horizontal cylinder engine with tubular boiler in its most perfect form by the same makers. All stuffing boxes in Messrs Tuxford & Sons' engines are of the neat and convenient form shown in half section and elevation in fig. 28. There are no counterweight on these engines. The boilers are all strongly stayed, and double felted and woodlagged wherever it is practicable. The engines are supplied with expansion valve and steam-jacket at a slight extra charge; in that case the steam jacket is supplied directly from the boiler, with a separate steam admission to slide jacket. The pump and valve box arrangement is such as to admit part of the feed water to be returned into the supplying tank or tub, thus enabling the pump to be always working, and pump barrel and valve box always full of water, besides heating the feed water.

Fig. 23.



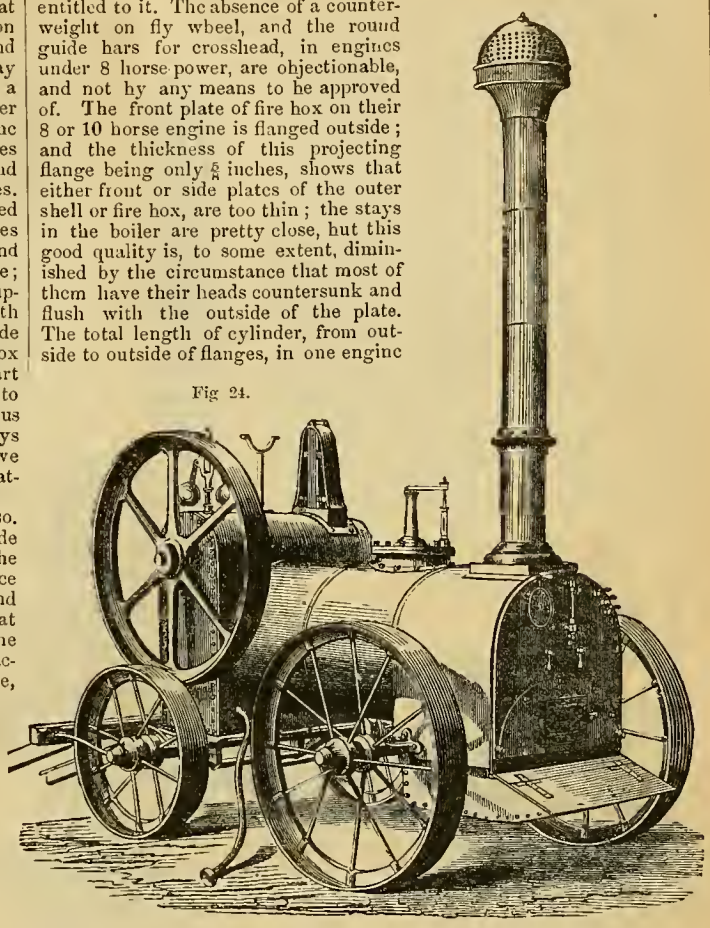
The engine shown in fig. 26, is a very well designed engine also. The feed can be regulated from the outside of the housing. The guide blocks are, in this engine, also lined with brass, and adjustable. The boiler is of the common locomotive stamp. It may not be out of place here to mention the following. The combined boiler with flues and return tubes, as shown in section in fig. 25, is not liable to leakage at the tube ends as the common locomotive boilers. This is owing to the fact that the thick flue plates have not the same variations in contraction from the cold air rushing through them as the thin tubes have, when the furnace door is opened for putting fuel on the grate; and further, the air becomes heated as it mixes with the flame, and when it arrives to the back uptake to return through the tubes, it is hot and nearly combined with the gases, and thus the tubes have never any cold air through them, and are free from that extreme variation in contraction and expansion, which tends to produce leakage at the tube ends.

The common portable engine manufactured by this firm, and shown in fig. 27, is as good a sample of its class as ever turned out. The cylinder is steam jacketed; the guide bars are of steel, and the guide blocks have adjustable brass linings on both sides; the brasses in crank shaft bearings are adjustable sideways. In fig. 29 is a vertical section, showing the construction of a Collinge patent axle box, as applied to Messrs Tuxford & Sons' portable engines. The oil dripping from the guides is used over again as the connecting rod dips into the oil collecting pan at each stroke. All the engines turned out by this firm are of superior material and workmanship. The 8 horse-power engine weighs 70 cwts, and, when fitted with steam jacket and expansion slide valve, (when will engineers cease to make the blunder of applying the latter, without, in that case, the unavoidably necessary adjunct of the former?) consume only $3\frac{1}{2}$ lbs. of coal per horse power per hour.

In the Western Annexe of the Exhibition, there was a portable engine, by Thwaites, of Bradford, for which a prize medal was awarded. Without admitting or expecting that the prize medals would, in all cases, have been awarded in the most judicious manner, which, indeed, on account of the immense labour, would, perhaps, have gone beyond the capability of human beings, still, we did not expect that such an engine as this one would, in the year 1862, have been held worthy of a medal. It may have done its work in the Exhibition without breaking down, but this should not be sufficient reason for putting the stamp of excellency on an engine so much out of proportion as it was. To give an instance—the writer, without asking the permission of Mr D. K. Clarke, who would most likely have turned him out immediately, as rule and measure were tabooed in that place, took the liberty of measuring the end of the crank shaft, where the fly wheel fits on, which was $2\frac{1}{8}$ inches in diameter, and the boss of the fly wheel was $7\frac{1}{4}$ inches diameter! One of the brasses on a crankshaft bearing projected $\frac{1}{4}$ inch beyond the other, and the bearings themselves were fixed to the top of the exhaust pipe. The fly wheel was very small, with a enormously heavy rim, which had arms about $1\frac{1}{4}$ inch diameter. Before entering upon a few remarks on foreign portable engines, let us yet mention one firm (though there are, no doubt, many more, but we must abstain from the Herculean task of enumerating them all) which takes a prominent position in the manufacture of portable engines.

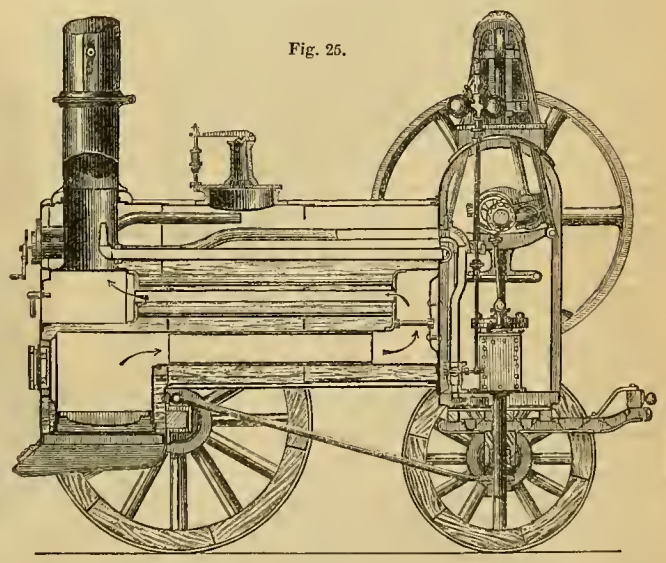
Messrs Barrett, Exall & Andrews, Reading, make good and strong portable engines, well-proportioned in most details: and having passed this encomium, it is right to mention some few points which are not entitled to it. The absence of a counterweight on fly wheel, and the round guide bars for crosshead, in engines under 8 horse power, are objectionable, and not by any means to be approved of. The front plate of fire box on their 8 or 10 horse engine is flanged outside; and the thickness of this projecting flange being only $\frac{5}{8}$ inches, shows that either front or side plates of the outer shell or fire box, are too thin; the stays in the boiler are pretty close, but this good quality is, to some extent, diminished by the circumstance that most of them have their heads countersunk and flush with the outside of the plate. The total length of cylinder, from outside to outside of flanges, in one engine with 14 inches stroke, measured about 32 inches; by better arrangement, it might be 3 or 4 inches less.

Fig 24.



The cylinders, from 8 horse power upwards, are steam jacketed, and have each a separate expansion slide valve. The weight of the

Fig. 25.

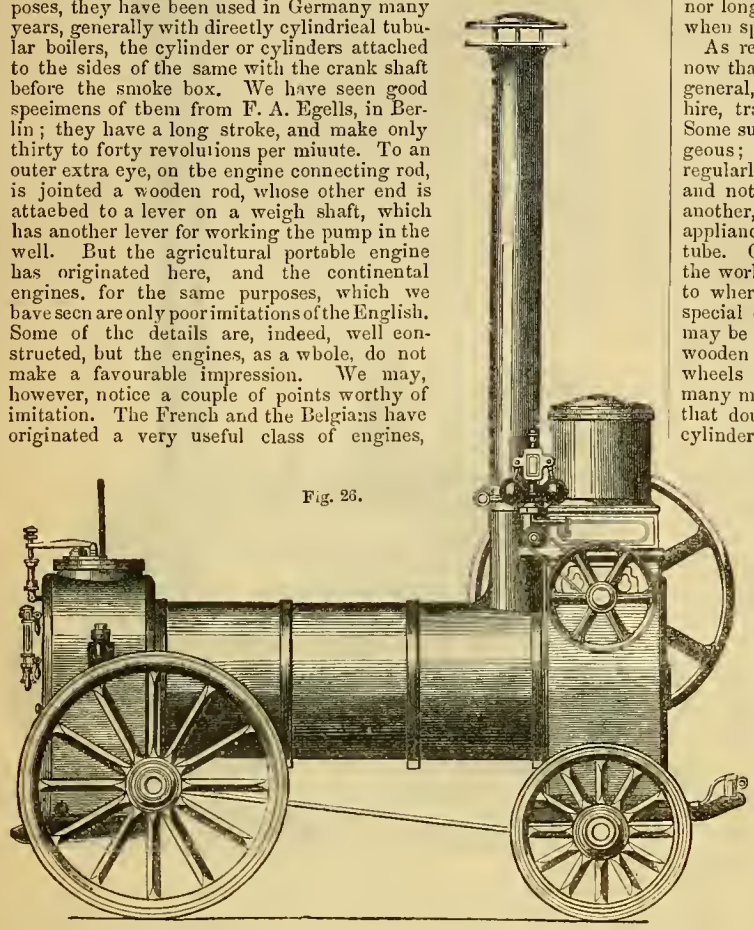


8 horse-power engine, without water in boiler, is 3 tons, and the consumption of coal about $9\frac{3}{4}$ lbs. per nominal horse power per hour, evaporating, in that case, nearly 10 cubic feet of water per hour; or

1 lb. of coal, 7·9 lbs. of water, the actual horse-power, cannot, we presume, be far short of 14 or 15.

Before concluding, we may give a few remarks on continental portable engines. As applied to mining purposes, they have been used in Germany many years, generally with directly cylindrical tubular boilers, the cylinder or cylinders attached to the sides of the same with the crank shaft before the smoke box. We have seen good specimens of them from F. A. Egells, in Berlin; they have a long stroke, and make only thirty to forty revolutions per minute. To an outer extra eye, on the engine connecting rod, is jointed a wooden rod, whose other end is attached to a lever on a weigh shaft, which has another lever for working the pump in the well. But the agricultural portable engine has originated here, and the continental engines, for the same purposes, which we have seen are only poor imitations of the English. Some of the details are, indeed, well constructed, but the engines, as a whole, do not make a favourable impression. We may, however, notice a couple of points worthy of imitation. The French and the Belgians have originated a very useful class of engines,

Fig. 26.

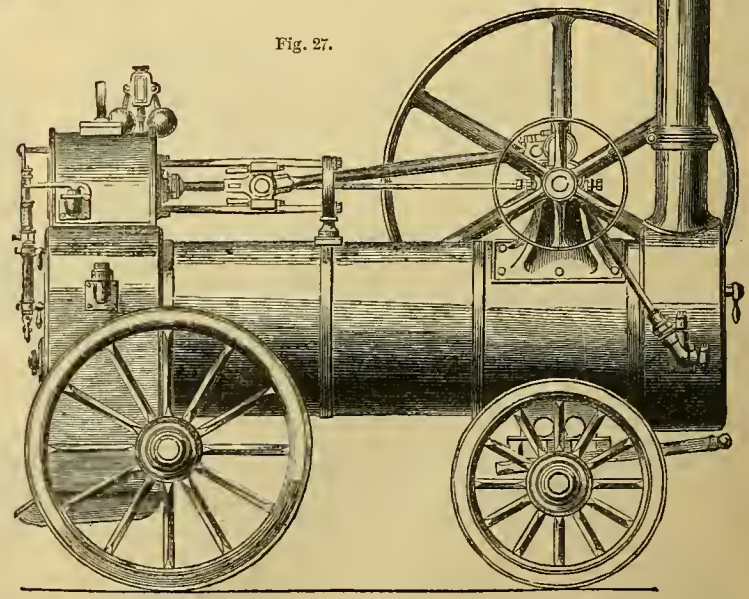


which may be termed semi-portable engines, and will, doubtless, become pretty general. As regards matters of detail, we have now and then, in French engines, seen a simple way of driving the feed pump, viz., from the slide valve rod, the plunger of the pump being in fact a continuation of the slide rod; the pump has a small gland at one end for the slide rod to pass through, and a larger one at the other for the plunger—a very snug arrangement, that saves an eccentric and a rod, and only involves a slightly larger plunger, as the area of the rod must be subtracted from the useful area of the plunger. The pneumatic governor is frequently used on the Continent; it is simple and cheap, and said to be very sensitive. At the late Exhibition, we particularly noticed a semi portable engine of MM. Thomas & Laurens, Paris; the boiler was cylindrical return tubular, with an immense water space behind the back uptake, to insure a steady water level; but, of course, causing delay in getting the steam up. The whole interior of the boiler was removable, to allow for cleaning and examining, somewhat similar to Balks and Biddells' plan, but having only one joint to loosen, viz., the front plate of the boiler from the barrel of the same, instead of two, as on their plan. By this arrangement, no undue strain comes on the joint. We have no doubt this plan could be employed advantageously in a great many other cases besides portable engines. There was also a simple good feed water heater on the boiler, the exhaust steam being used for that purpose; it was, however, rather in the way for getting at the piston.

Having thus given a sketch of the portable engine of the past and present, we may, perhaps, indulge in a few speculations as to the future of the same. We have, probably, only seen the beginning of these machines; in future, we shall see them still more generally employed—in many instances, modified to suit the several special purposes. We may as well at once allude to the useful engines called semi-portable (Fr. demi fixes). If we can get a good useful engine, that requires scarcely any foundation, no brick chimney, nor boiler seating, nor long connections of steam and feed pipes, etc., why not, especially when space is valuable, use such a semi-portable engine.

As regards the portable engine, properly so-called, we see already, now that the practice of making them self-propelling is becoming pretty general, a very useful improvement, especially for engines, to be let on hire, travelling about from one place to another, doing "odd jobs." Some such other additions and improvements may be found advantageous; but we think that portable engine makers will soon begin regularly to manufacture two classes of engines—one cheap and simple, and not especially designed for economy in consumption of fuel, and another, with expansion valve, steam jacket, and other economising appliances, with a boiler on the plan of—for instance—Tuxford's return tube. Generally speaking, all portable engines ought to have, at least, the working parts protected by a casing, which allows of getting easily to wherever required, as we have seen made at Ransomes & Sims' on special order; or, else the plan adopted by MM. Laurens & Thomas may be employed, consisting in enclosing the whole engine in a light wooden shed, with only the top of the chimney and the travelling wheels exposed. The double cylinder construction, now adopted by many makers, does not seem to us to be the right thing; but we think that double cylinder expansive engines, with a proportional area of cylinder of say three to one, could be got up, without much more expense, and, at the same time, be a good deal more economical. When using a high degree of expansion, it would, perhaps, be found both simple and convenient to let the governor regulate the expansion; different modes for attaining this object are used, all over the Continent, in stationary engines—probably, Mayer's (a German maker) is the simplest and best. If feed pumps are to be used at all, let them be driven as explained at the French portable engines. Both these chief divisions of engines are again to be divided into several classes, as agricultural, pumping, etc. Minute divisions of labour in factories, on a still larger scale than now, will reduce the price, and, at the same time, admit of the use of better material and workmanship. Then, again, malleable cast iron may be found useful in many instances, as applied, for instance, to man and mud hole doors, travelling wheels, tooth gear for self-propelling, etc. We especially recommend, not to forget the importance of a good and economical boiler, with easy access for cleaning internally. Too much stress is generally laid upon the saving to be effected by the construction of the engine; but let it be borne in mind that the cheap

Fig. 27.



generation of the steam is the first and important point to be considered, and here is scope enough for ingenuity and practical abilities; after all is done on this head, let us then try to get the greatest possible amount of work out of the steam. If the portable engine makers go steadily on with improvements, in design and construction, as heretofore, they will find a still better market for their

Fig. 28.

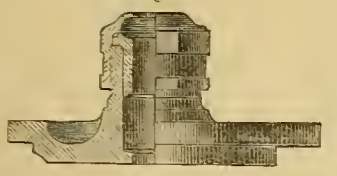
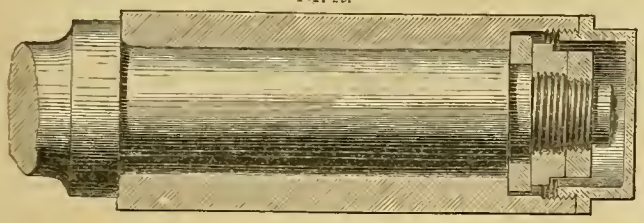


Fig. 29.



engines all over the world and we, on our part, heartily wish them success.

P. J.

ON SOME POINTS OF DIFFERENCE BETWEEN ENGLISH AND AMERICAN PATENT LAW.

We have before us a "Digest of American cases relating to patents for inventions and copyright from 1789 to 1862, embracing, also, the American cases in respect to trade marks, by Stephen D. Law, Counsellor at Law, published, by the author, at New York."

An elaborate notice of a work of this nature would be out of place in an English periodical, even if it were possible to pass a satisfactory judgment on the book, deprived as we necessarily are of the power of comparing the digest which is presented to us with the original cases as they stand in the American reports. It will be sufficient, therefore, to state that the work bears outward tokens of having been the result of great labour, that no less than 834 cases have been comprised in it (of which 734 have reference to patents), that many of such cases are taken from manuscript notes, hitherto inaccessible to the American lawyer, and that the author claims to have not been content merely with the head notes of the reporters, but to have carefully read and digested the various cases for himself. The work, therefore, would seem to be one which will be of great value to practitioners in the United States.

But although English lawyers and patent agents are not likely to make much use of a book which comprises only American decisions, it is worth while to glance at its pages at the present time, when our own patent law is, to all appearance, about to undergo revision, and when a commission, the result of whose labours will probably soon be before Parliament, is actually sitting to consider the subject. We think we shall be rendering some service to the cause of patent law reform if we call attention to a system in many respects different from our own, but which yet is found to work well in a society with which we have much in common, and whose general jurisprudence in most essential points is substantially the same as ours. We propose merely to lay before our readers some of the points of difference between the English and American system of patent law, leaving them to form their own judgment as to which system is the most satisfactory.

And first, as to the process of obtaining a patent. From the cases collected in Mr Law's volume, it seems that no patent is granted in America without a full preliminary examination of the claims of the alleged inventor. This examination is made by a commissioner, who himself ascertains whether the claimant's invention has been anticipated in any patent, and if so, either refuses the application, or declares an "interference," upon which the parties who would be affected if the inventor's claim be granted, are heard, to oppose the issue of a patent to him. Here is one point of difference between American and English law. We have no preliminary investigation, except that which may be undertaken by an opposer at his own expense. If a patent be unopposed, it is passed in England almost as a matter of course. In America, on the other hand, a preliminary investigation is made on the part of the state, whether the patent be opposed or not, and, indeed, it would seem that opposition to the grant only takes place on the invitation, as it were, of the commissioner, who, by announcing that the proposed patent is in conflict with existing rights, virtually calls upon the owners of those rights to defend them.

Importers, who are not actual inventors, cannot obtain patents in America, the principle of the system being to confine the reward given to a new discovery, to the personal merit of the discoverer. It follows from this, therefore, "that the first inventor is entitled to a reasonable time in which to perfect his invention. If he uses reasonable diligence, he will not lose his right, through another first making a working invention." So, also, "if a person after having the conception of an invention is using due diligence to perfect it, and reduce it to practice, he will still be deemed the first inventor, though another, who conceived the idea later, may have first perfected the idea, by manufacturing the thing invented." But American law will not allow an inventor to keep his invention to himself, and to publish it at the time which he may find most convenient, and, therefore, it is held that such a person "does not come within the policy of the constitution or acts of Congress, and is not entitled to favour, if, during such concealment, another person should find out and bring into use the same invention."

The difference between such a system as this and our own is obvious. Here, if a man has once obtained a patent on the false allegation that he is the inventor, the actual inventor can upset the patent by showing the falsity of the statements on which it was obtained, but cannot obtain protection for himself, for the very fact of the invention having been embodied in a patent, (though that patent might be invalid), would render null any subsequent letters patent. In such an event, the original inventor would, in America, have the same rights as if the invalid patent had not been granted. A case in which these questions actually arose is reported in this Journal, ante p. 242, under the name of Silverthorn's assignees, *v.* Mitchell. Indeed, points like this appear, from the digest before us, to form a large ingredient in American litigation.

Again, in this country an action for infringement of a patent may be defeated merely by showing that the specification claims something to which the patentee is not entitled, and this, notwithstanding the part so claimed is not alleged to have been infringed. In America, on the contrary, he may recover damages for the infringement in such a case, but, inasmuch as he ought to have disclaimed the part to which he is not entitled, he will have no costs.

A patentee, however, is bound to disclaim, as soon as he discovers that he has claimed more than he has a right to, and the above rule will only apply when there has been no unreasonable delay in disclaiming; but if the jury are satisfied that there has been such unreasonable delay, the whole patent is invalid.

Further, our law bears hard upon patentees, inasmuch as it allows a patent to be avoided by any omission in a specification to describe the invention properly, or to disclose the whole of it, notwithstanding that the omission may have been unintentional. In America, no defect or concealment in a specification will avoid a patent, unless it arose from an intention to deceive; and it has been laid down by Mr Justice Story, that "if a specification be not so full, clear, and exact, as to enable a skilful person to correspond and use the same, yet this does not avoid the patent unless the defective description has been made for the purpose of deceiving the public." Moreover, the patentee is not bound to prove that he framed his specification with an honest intent. Those who attack the patent, must establish the fraud. The same law appears to hold when the patentee has by mistake claimed more than he is entitled to. The American rule in this respect as opposed to that of our courts, has been adopted in the code of Patent Laws recently enacted for India (see *Practical Mechanics' Journal*, Vol. iv. Second Series, p. 147).

Such are a few of the points of difference between English and American Laws suggested by the book before us. There are probably many others which a closer examination of Mr Law's book would reveal, but the above lie on the surface, and are, we think, sufficient to show how desirable it is that any measure for the reform of English patent law, should be preceded by the most careful examination into the systems which obtain in other countries.

RECENT PATENTS.

POWER LOOMS.

Crawford & Templeton, *Beith.—Patent dated February* 17, 1862.

This invention relates to the arrangement and construction of looms for weaving, the principal object of which is to ensure an uninterrupted supply of weft by self-acting means, so that the weaving may be carried on without interruption. Under one arrangement, this is effected by means of the shuttle, which is constructed in such manner that when the weft is exhausted, a spring is liberated, which brings into action the mechanism by means of which the shuttle box is shifted, so as to bring a new shuttle into operation. The second part of the invention has reference to an arrangement, to avoid stopping the loom, either upon the weft being broken, or becoming exhausted, and may be used independently of the first part of this invention, if required. The third part of the improvements has reference to a mode of weaving checked, striped, and figured fabrics, by means of an arrangement or application

of the mechanism for operating the rotatory shuttle box, so as to bring different coloured wefts into operation, as required, to produce the desired pattern.

Fig. 1.

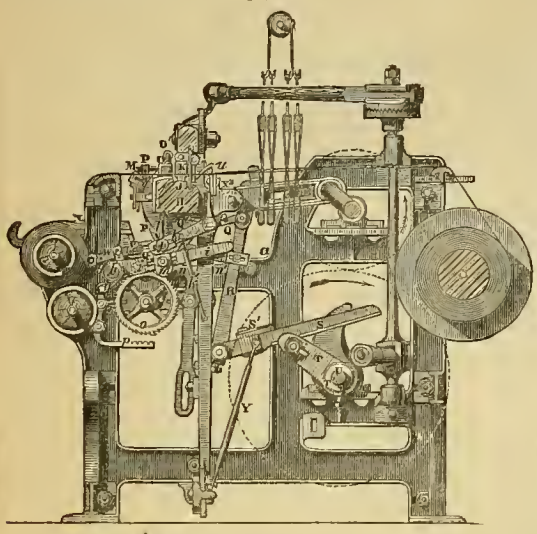


Fig 1 of the subjoined engravings is a transverse sectional elevation of a power loom, fitted according to these improvements; and fig. 2 is a plan of the same loom, corresponding to fig. 1. Fig. 3 is a longitudinal sectional elevation of the rotatory shuttle box; and fig. 4 is an end view of the same, showing a portion of the mechanical arrangement for actuating the shuttle box. Fig. 5 is a sectional elevation of the improved shuttle, showing the spindle and pirn placed thereon; and fig. 6 is a plan of the same, showing the pirn as partly filled, with the side spring in the released position, which would cause a new shuttle to be brought into action, the weft in that case being supposed to be exhausted. According to one modification of this invention, the shuttle is the means by which the shuttle box is turned, and a new shuttle is brought into operation when the thread on the pirn is nearly finished. First, then, to describe the improvements in reference to the construction and action of the shuttle.

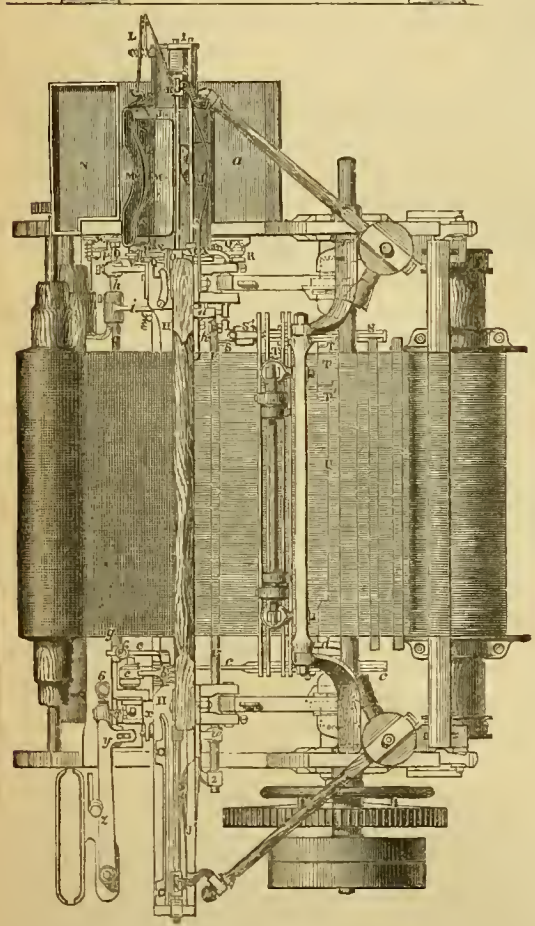


Fig. 2.

The main portion of the shuttle, A, is made according to the ordinary system; the spindle, B, on which the pirn is placed, is fitted on a pin passed through the shuttle, and upon which it turns. The spindle has brazed to its point, or outer extremity, a blade spring, C, which curves slightly outwards just beyond the solid part, and then forms a sudden rise or bend, terminating in a bent part, which enters and passes through a hole, formed for the purpose, in the backward end of the spindle, as shown in figs. 5 and 6. The pirn, D, is made with a slot, E, fig. 5, at the backward part, so that when the pirn is placed on the spindle and pushed up to its shoulder, the backward curved portion of the spring has free play in the slot, and extends above the diameter of the pirn; but this is not the case when the weft is wound thereon. In winding the weft, a small portion is wound near the centre of the pirn; the conical portion of the pirn is then wound and completed in the ordinary way. When the pirn is placed on the spindle, B, the pressure of the weft at the slotted part of the pirn causes the spring, C, to be depressed, so that its free extremity projects out beyond the hole in the spindle. The heel of the spindle rests on a blade spring, F, which holds it steady when placed either in the horizontal or vertical positions. A recess and slot is formed in the side of the shuttle, in which is screwed the spring, G; the end of this spring is bent at right angles to its length, and curves inwards, as shown in fig. 6. When the pirn is placed on the spindle, and pushed up to the shoulder, the swell at the front portion of the spring, C, serves to hold the pirn firmly in its place. The spindle is then turned down to the horizontal position, at the same time the spring, O, is pushed inwards, so that the point of the spring, C, which is projecting below the spindle, enters a hole in the bent part of the spring, G, and which comes immediately under the point of the spring, C, when pressed inwards in the manner described In this position, the spring, G, is flush with the side of the shuttle, and it passes freely in and out of its cell in the rotatory shuttle box. When, however, the weft becomes exhausted, and the portion which covers the conical part of the pirn is unwound, the spring, C, rises and liberates the spring, O, which starts out beyond the side of the shuttle, as dotted in that position in fig. 6. This projecting part comes into contact with the mechanism to be presently described, which causes a partially rotatory movement of the shuttle box to take place, and another shuttle is brought into action. The small quantity of yarn wound on the pirn, at the central part, ensures a due supply of weft to complete the shot, after the spring, C, is liberated, and this prevents any defects in the cloth which would arise from a deficiency of weft. These shuttles are also adapted for being used with ordinary cops, in which a paper tube takes the place of the pirn; to adapt these tubes to this improved shuttle, it is necessary to make a longitudinal cut or slit in the tube, or, otherwise, to form it of paper sufficiently thin to break and liberate the spring, C, upon the weft being expended. The mechanical arrangements for effecting the change of the shuttle, either upon the weft being exhausted, or from its breaking during its traverse through the shed, are shown in figs. 1 to 4 of the accompanying engravings. In these figures, there are numerous parts which are common to all modern power looms, and therefore need not be particularly described. The lathe, H, has fixed to it the laterally projecting spindle, I, on which are fitted the bearings of the rotatory shuttle box, J; the space beyond the outer bearing, to the end plate of the spindle, is filled in with a cylindrical piece of wood, grooved at the upper part to receive the picker, K, and afford the necessary space for the picker and shuttle The picker is wrought in the ordinary way, by means of the picking stick; but there is an arrangement for causing it to be brought back rapidly, irrespective of the motion of the picking stick. A small pendant arm is fixed to the stationary end piece of the shuttle box; this arm carries the helical spring, L, one end of which is fast to the projecting stud of the arm, whilst the other is prolonged upwards, and terminates in an eye. A small strap or cord is attached to the picker, K, passed through the eye of the spring, L, and the ends fastened to an eye fixed to the frame of the shuttle box. When the picker has struck the shuttle, and completed its forward traverse, the spring, L, is then free to act, and draws the picker back with great rapidity. In this modification, the shuttle box, J, is shown constructed with six cells for receiving the shuttles, but this number may be varied, if required. In front of the shuttle box, is fixed a small metal bar, to which is attached an open frame, or mouthpiece, M, to receive the filled shuttles, as they require to be passed into the cells of the shuttle box, J. Below the open frame, or mouthpiece, M, is a small shelf, N, to receive the shuttles in readiness to be passed into the mouth, M. To prevent the shuttles from flying out of the mouth, M, there are two small springs fitted to the ends of the frame, M and a loose plate, M^1, which readily admits of the shuttle passing inwards, but falls forward into an angular position that prevents the egress of the shuttle. The mouthpiece, M, may be made of any convenient depth, so as to hold a number of shuttles, in which case it is preferred to fit it with the end springs and loose plates corresponding to the number of shuttles the mouthpiece is intended to hold. With this arrangement, the loom attendant has only to place the filled shuttles in the opening, M, from time to time, to ensure the cells of the box, J, being properly supplied; for, as the empty cells are brought round, the filled shuttles instantly drop in. The rotatory shuttle box is moved round by automatic means in the following manner.—Let it be assumed that the weft on the operating shuttle has been so far exhausted as to liberate the spring, G, as it passes through the shed in either direction, the quantity of yarn wound on the central part of the pirn, as before explained, will be suffi-

cient to complete the pick. As the shuttle traverses into its cell in the box, J, the spring, G, comes into contact with the lower edge of the plate, O, which serves to retain the shuttle box in its place during the weaving; this plate is centred on a stud at the inner end, as shown in fig. 3. The lower edge of this plate, O, forms an inclined plane, so that as the shuttle passes into the cell, the plate is raised and lifts the link, P, which is connected to the plate, O, by a stud projecting out from it in front. The link, P, is slotted at its lower end, as shown in fig. 4, and is connected by a stud to the bent lever, Q; this lever is attached at its backward end to the lever, R. This lever is fast to a short horizontal shaft carried on the sword of the lathe, H, and to this shaft is connected by a pinching screw the horizontal lever, S, the two levers, R and S, forming a kind of bell crank lever arrangement. These levers receive a constant reciprocatory movement while the loom is in motion from the arm, T, which is fitted on the tappet shaft, U; as the shaft rotates the antifriction roller carried on a stud in the slotted extremity of the arm, T, raises the lever, S, and moves the levers, R and Q, forward, and so long as the weaving is proceeding regularly, this to and fro motion goes on without producing any other effect. But when the link, P, is raised by the action of the shuttle on the plate, O, the front extremity of the bent lever, Q, is raised above the stud, V, which projects laterally from the arm, W. This action lifts the finger, Q^1, of the lever, Q, sufficiently high to catch the contiguous tooth of the ratchet wheel, X, on the inner end of the shuttle box, J, the object of the stud, V, being to retain the lever, Q, in position, whilst the forward motion of the lever, R, pushes the shuttle box round so that another cell with a full shuttle is brought into a line with the shed. The shifting of the several parts to bring the new shuttle into operation is effected with instantaneous rapidity, so that the weaving goes on without interruption To guard against breakage of the parts of the movement, should there be a stoppage in the shifting mechanism from any accidental cause, the lever, S, is jointed near its inner end, but the lever is prevented from bending each time the lever, T, comes round by the flat spring, S^1, which consists of one or more pieces of flat steel extending over and pressing on the moveable part of the lever, S. Should any extraordinary pressure or retarding force be brought on the lever, S, the spring, S^1, gives way, and prevents injury to the other parts. An india rubber or other spring, Y, is attached to the lever, S, and the lower part of the lathe sword which draws the lever back to its usual position after being raised by the arm, T. This arm is fitted loosely on the tappet shaft, U, with a species of coupling which is shown more clearly in fig. 2; there is a fixed collar on the shaft, having a step like recess in it, and on the inner side of the arm, T, is another and similar collar, which is fitted to the shaft with a pinching screw. The boss of the arm is recessed to correspond to the collars on each side. The effect of this arrangement is that when the arm is moving round towards the lever, S, it is actuated by the T-shaped projections on the boss of the arm being in contact with the corresponding recessed parts of the collars, T^1. This continues until the lever, T, is raised to a position at right angles to the lever, S, when the arrangement of the collars, T^1, admit of its falling forward a certain distance until again checked by the recessed parts on the further side of the collars. By means of this accelerated movement of the lever, T, it is kept clear of the other parts as the lathe is moving backwards. The several cells of the shuttle box, J, have a part cut away at the sides, as shown in fig. 4, for the purpose of allowing the shuttle to move freely into the cell after the spring, G, is liberated. A groove is also formed in the shuttle box, J^1, on the opposite side of the loom, for the same purpose, in case the spring, G, should be liberated whilst the shuttle is traversing towards that side of the loom. Whilst the lever, Q, is shifting the ratchet wheel, X, round to the extent of one-sixth of the rotatory shuttle box, the uplifted link, P, descends, its lower end being slotted to allow of this downward movement, so that the plate, O, is again brought into its normal position in the new cell of the shuttle box, and the weaving goes on with the shuttle contained within it. To the face of the plate, O, is fixed a small bent spring, O^1, which is furnished with a stop to prevent the free end of the spring from extending out too far while the plate, O, is raised. When the plate, O, is raised, the spring, O^1, extends a little over the edge of the shuttle box so as to prevent the descent of the plate, O, back into the cell from which it has been lifted, but the shuttle box in its forward movement is carried sufficiently far to allow the plate, O, and spring to fall into the new cell. When the change in the shuttle box has been made, the ratchet wheel, X, is retained by the pendant catch, X^1, which is pressed forward over the tooth of the ratchet wheel by the blade spring, X^2. As the shuttle box is moved round, the shuttle that is out of action is prevented from being thrown out of the cell through the vibration of the lathe by the wire, Z, which is fastened to the lathe and extends over the cell, and at the next movement of the shuttle box the shuttle falls out from the cell on to the shelf, *a*, from whence they are taken to be refilled at leisure. These improvements also comprehend an arrangement to be used in conjunction with the hereinbefore described mechanism for shifting the shuttle box, but in this arrangement the shifting action is effected by a modification of the weft fork action, and is brought into operation either upon the breaking of the weft or its becoming exhausted. This is done by an arrangement of the weft fork which is used for effecting the change in the shuttle box, in place of stopping the loom as heretofore. The weft fork, *b*, is balanced in the usual manner, and upon the weft breaking, the backward end of the fork falls and comes in contact with the upper end of the bell crank lever, *c*. The lever, *c*, is fitted on a stud projecting inwards from the loom framing, and this lever is kept vibrating to and fro by the action of the lever, *d*, on the shaft, U, which is fitted on the shaft in manner similar to the lever, T. The action of the lever, *c*, moves the bent arm, *e*, which is fixed by a pinching screw to the upper end of the lever. *f*; this lever is fast to a tubular shaft, *g*, carried on the shaft, *h*. The tubular shaft, *g*, is kept in its place on the shaft, *h*, by end collars which are fixed by pinching screws, and the motion of this shaft caused by the lever, *e* and *f*, raises the lever, *i*, which in its turn lifts the stud, *j*, projecting laterally from the bell crank lever, *k*. The stud, *j*, carries at its outer end a small vertical rod, *l*, which, upon being raised, lifts up the plate, O, and so liberates the rotatory shuttle box. This action brings the lever, Q, into operation, and the shuttle box is turned one cell, as previously described. The lever, *k*, is brought back to its normal position by the spring, k^1. The lever, *i*, is slotted longitudinally, and in this slot is carried a laterally projecting lever, *m*, which raises the pawls, *n* and n^1, out of the ratchet wheel, *o*, so as to let back one or more teeth of the wheel while the change of the shuttle box is made. The bent lever, *p*, is so arranged as to let back the ratchet wheel, *o*, one or more teeth as may be required by the actiou of the adjustable stop on the lever, *p*, the pawl, *q*, of which falls into the teeth of the ratchet wheel, *o*. The adjustable stop, *x*, which is carried in a slot formed in the lever, *p*, has a notch formed in it which catches the framing, and the stop may be set so as to allow the ratchet wheel, *o*, to turn back one or more teeth as may be required, in order to prevent any breaks or deficiency in the woven fabric. The lower part of the lever, *p*, is bent inwards to allow of a counterweight being hung thereon if required. In case the shuttle should be caught in the shed, the shuttle box is provided with a self-acting arrangement or swell for bringing the stop motion of the loom into action. Above the shuttle box, J, is arranged a small horizontal shaft, *s*, which swings freely in its bearings, and is formed with the pendant projecting part, *t*. As the shuttle traverses to and fro, the pendant, *t*, is pushed outwards by the shuttle, which causes the shaft, *s*, to turn upon its axis, and causes the pendant lever, t^1, on the end of the shaft, *s*, to push back the lever, *u*, which is fast to the shaft, *v*. The motion of the shaft, *v*, about its axis raises the lever, *w*, which lifts the catch, *x*, so that it moves forward clear of the projecting stop on the vertical blade spring, x^1, which consequently remains in its normal position. But if this sequence of movements should not take place owing to the absence of the shuttle, the catch, *x*, comes in contact with the stop on the spring, x^1, so that the screw in the upper end of the spring pushes back the lever, *y*, which instantly starts the spring lever, *z*, from its retaining catch, and the loom is stopped by the strength of the spring and the shifting of the strap. The shuttle box, J^1, is provided with the usual spring, 1, at the back, which spring acts on the lever, 2, fast to the end of the shaft, *v*, the absence of the shuttle causing the loom to be stopped, as before described. Hinged to the shaft, *s*, or other convenient part is a flap piece or loose back in front of the lathe sword and in a line with the reed, so as to allow the shuttle box to rotate freely although the shuttle should not be driven fairly home. Fig. 7 is a partially sectional elevation, showing an arrangement for actuating the rotatory shuttle box in a predetermined order or sequence, so as to adapt the loom for weaving checked, striped, or figured goods,

Fig. 3.

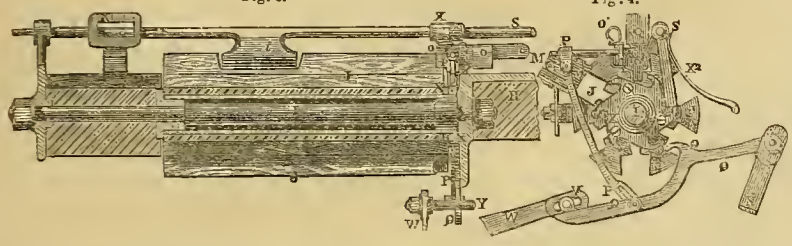


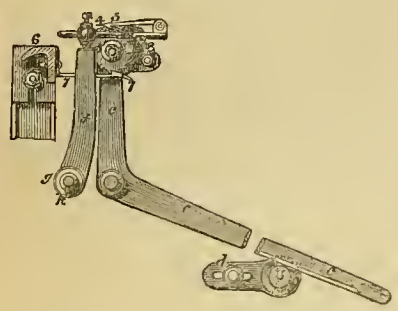
Fig. 4.

Fig. 5.

Fig. 6.

in which the patterns are produced by an alternate or regular succession of colours. In this modification, the bell crank lever, *c*, which receives its reciprocatory movement from the tappet lever, *d*, on the shaft, U, has at its upper end a slot in which is fitted a stud carrying the ratchet wheel, 3, which is formed of a thin plate of iron, or other suitable material. Inside the ratchet wheel, and on the same stud, is fitted a pattern wheel, 4, the periphery of which is notched in such manner that a given number of shots of weft may be thrown in between each notch, the distance between the notches serving to regulate the shifting of the shuttle box, and so cause it to change more or less frequently, as the pattern may require. The lever, *f*, has fitted to it an inwardly projecting rod, which carries the pawl, 5; this pawl, 5, is broad enough to rest on the pattern wheel, 4, and partly extends over the segmental end of the lever, *c*. To the breast beam, G, is fixed the spring pawl, 7, which takes into the teeth of the ratchet wheel, 3; this pawl is made with its catch directed inwards, to allow the ratchet wheel, 3, to be moved round by the action of the lever, *c*, in conjunction with the fixed pawl, 7. The upper end of the lever, *c*, is made with a laterally projecting part, which is slotted and fitted with the pawl, 8, which prevents the ratchet wheel, 3, from turning in the opposite direction. As the lever, *c*, rises and falls with the action of the arm or tappet, *d*, the ratchet wheel, and the parts connected, move to and fro, the forward movement being sufficient to allow of the pawl, 7, taking into another tooth of the ratchet wheel, 3; and this movement of the ratchet wheel, tooth by tooth, takes place at each rotation of the tappet shaft, U. The pattern wheel, 4, moves in unison with the wheel, 3, the two being connected together; the adjustment of the joint movement is obtained by the frictional contact of a washer of india rubber, or other suitable material, the pressure of which is adjusted by a nut on the stud. Whilst the periphery of the pattern wheel, 4, is moving beneath the pawl, 5, the weaving goes on with the coloured weft, that at the moment is being woven in, but on the pawl, 5, falling into one of the notches of the pattern wheel, 4, it, at the same time, takes into a corresponding notch formed in the upper face of the segmental end of the lever, *c*, and the forward motion of this lever causes the lever, *f*, to be brought towards the breast beam, 6. This motion of the lever, *f*, turns the tubular shaft, *g*, partially on its axis, which causes the lever, *i*, to raise the rod, *l*, and operate the intervening parts, so as to raise the plate, O, in the manner hereinbefore explained. The raising of the plate, O, causes a new cell of the shuttle box to be brought round, in which is a shuttle carrying a differently coloured weft. The weaving, with this second weft, goes on, until another notch in the pattern wheel is brought round by the motion of the ratchet wheel, when a change takes place, and so on throughout the series. In lieu of the pattern wheel, 4, an endless band may be arranged in such manner as to bring the cells of the shuttle box round in succession. This band consists of a series of cards or plates, formed of metal, or other suitable material, connected together, so as to be quite flexible; the band passes over a small barrel on the stud of the lever, *c*, the end of the barrel having on it the ratchet wheel, 3, by which it is moved, step by step, carrying with it the flexible band. Holes are made in the plates forming the band, at distances asunder, agreeing with the changes required in the weft, so that, as the band moves round, and the pawl, 5, falls into one of the holes, the change is effected. In this arrangement, the weft fork is fitted in the ordinary way in the lever, *y*, for stopping the loom on the breakage of the weft. In this modification or arrangement of the loom, for producing stripes, or other patterns, the shuttle box, J, is fitted with an external casing, so as to admit of its making the rotatory movement without displacing the shuttles; or, in lieu of this, the box may be supplied in the ordinary way by passing the shuttles through the mouthpiece of the shuttle box as they are required—the used shuttles being discharged in the manner hereinbefore described. By means of the foregoing mechanical arrangement, different colours of weft, or sizes of yarn, may be introduced at pleasure into the woven fabric, and, in this way, a great variety of checked, striped, figured, and other generally similar goods may be produced in the looms.

Fig. 7.



APPARATUS FOR THE MANUFACTURE OF IRON AND STEEL.

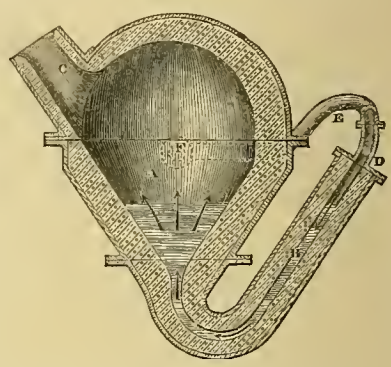
E. B. Wilson, *Engineer, Westminster.—Patent dated April* 27, 1862.

This invention relates to certain peculiar constructions and arrangements of apparatus, employed in the manufacture of malleable iron and steel, by what is known as the atmospheric process.

In the manufacture of malleable iron and steel, by the well-known process of forcing atmospheric air beneath the surface of the molten metal, it has been found that, by reason of the tuyeres or air pipes being situate at the bottom of the converting vessel, and being consequently, when in action, always covered by the molten metal, they are quickly destroyed, and rendered unfit for service. Their renewal is a serious inconvenience, and occasions a great loss of time, as the converting vessel, at each renewal, must be allowed to cool down before a fresh tuyere or set of tuyeres can be introduced. In addition to the inconvenience mentioned, there is the additional inconvenience in the old arrangement that the molten metal is apt to flow into the tuyere the moment the upward blast ceases, and thus they become plugged up.

Now, the object of this invention is to obviate these difficulties by placing the tuyere or tuyeres of the converting vessel (which is usually suspended on axes,) above the molten metal, and to blow down upon or through the metal in place of blowing up through the same as heretofore.

The annexed engraving represents a vertical section of one form of the improved arrangement of converting vessel and tuyere. The main, or principal part, A, of the vessel may be either cylindrical, spherical, oval, or of any other suitable form, but its lower part is curved upwards, as shown at B, and is closed at the top—the parts, A and B, having the form of an inverted syphon. The other, or main orifice, or mouth, C, of the vessel being always left open. The nozzle, N, of the tuyere is connected to the top of the part, B, by the pipe, E, with one of the trunnions or axis, F, of the vessel, in any convenient or well known manner, so as to allow of the vessel being turned or reversed without interfering with the blast pipe. The surface of the molten metal is thus kept some distance below the orifice of the blast pipe or tuyere. The blast of atmospheric air is then turned on, and being blown down upon the surface of the metal in the part, B, of the vessel, it forces its way down the part, B, driving the molten metal, contained therein, before it, and escapes upwards in the form of air bubbles, through the mass of metal contained in the main body of the vessel, A, as indicated by the arrows, and passes out with the gases and products of combination through the open mouth at C. It is thus evident that no burning of the tuyere can possibly take place, as it is never in contact with the metal, although the patentee prefers the peculiar form of vessel, illustrated and described. It may be constructed otherwise, in many respects, so as to fulfil the same end, namely, the saving of the tuyere from burning and destruction; as, for example, the vessel may be curved in the form of a crescent, one of the horns of the crescent being left open, and the other closed by the introduction therein of the nozzle of the blow pipe or tuyere, the level of the molten metal being some distance below the nozzle of the tuyere so as to be entirely out of contact therewith. The vessel would be supported at its centre on trunnions which would admit of its being turned over for the purpose of emptying the same.



Although the converting vessels are described as being suspended on centres or axes for the purpose of facilitating the emptying of the same, it is obvious that the same arrangement of tuyere is equally applicable to stationary vessels.

MANUFACTURE OF COLZA, RAPE, AND OTHER OILS.

J. H. Johnson, *London and Glasgow*, (C. H. Michaud, *Paris*).—*Patent dated May* 13, 1862.

These letters patent specify an improved process of purifying colza, rape, and other oils, whereby a superior product is obtained, with a considerable economy of time, and at a reduced cost. According to this invention, it is proposed to subject the oil under treatment to violent agitation in a suitable vessel, with a view to the mixing of air or gas therewith, sulphuric acid being poured gently into the oil during such æratiug process. In lieu of employing heaters, agitators, or other mechanical means for introducing and mixing the air with the oil, a perforated pipe may be placed near the bottom of the vessel, and air or gas forced thereiu, such air or gas permeating the oil in innumerable small streams or jets. The scum which rises to the surface is then removed, and the agitating process is repeated, the fresh scum being removed between each agitation. At the last agitation a small quantity of water is added, so that the oil becomes thoroughly mixed with air and water. The sulpho-fatty acids are then destroyed, and the sulphuric

acid is drawn off, and the impurities removed by washing the oil in hot water, or by steam. The oil is now dried over a fire, or by steam heat, and is afterwards cooled by any suitable refrigerator, when it will be found to be perfectly pure, and ready for the market.

In practically carrying out this invention, the oil to be purified is poured into a wooden vessel, or one lined with lead, such vessel being deeper than it is wide, and provided near its bottom with a spiral perforated lead pipe, which is continued outside, and rises vertically up the side of the vessel, so as to communicate with a blower. This induction of air has been found to be the best mode of intimately mixing a gas with the oil; but a brisk agitation by mechanical means, especially in a closed vessel containing the oil and the gas, will also produce a good result. In this vessel the oil is usually subjected to four successive and distinct agitating processes. After each agitation, the oil is allowed to stand and the scum is removed. The first agitation is effected during and after the gradual addition of sulphuric acid. The second agitation is for the purpose of forming a further collection of scum similar to the first. The third agitation serves not only to incorporate still more air with the oil, as in the previous agitations, but at the same time to mix therewith a small quantity of water, equal to one, two, or three per cent. of the weight of oil. Finally, the fourth and last agitation, which may sometimes be dispensed with, is for the purpose of facilitating the removal of the remainder of the scum. These various agitations having been continued intermittently during a period of six or seven hours, the oil will be found to have assumed as good an appearance as the oil purified by the lengthy and tedious processes hitherto adopted, and requires only to be filtered. This operation may be carried out either immediately, or which is better, after the oil has been washed in cold water, and allowed to stand a day or two. This would amount to a combination of the old system with the present improved process; but as under these improvements it is preferred to dispense with the filtering process, and treat the oil as follows:—The oil which is to be washed falls into a wooden vat, or by preference a copper vat, but a copper vat silver plated is still more preferable.

This vat is placed underneath the first-mentioned vessel, but if it is desirable that the second vat should be alongside of the first at the same height on the same floor of the manufactory, the oil must be brought there by pumps. This washing vat is closed, but has several openings on the top. Steam is introduced into this vat through a perforated spiral copper pipe, placed near the bottom, which is inclined from the back to the front, or from the circumference to the centre.

At the lowest point in the bottom of the vat, there is an outlet cock for the water, and on the side of the vat one or two outlet cocks for the oil. Water is first introduced, which is made to boil, and then the oil is added.

The oil and water are then boiled for about one hour, after which the acidulated water is drawn off; and in order to remove the last trace of acid, a second washing is effected. Subsequent washings cannot but be serviceable, but they are not necessary, especially if burning or lamp oil is being treated. When the last washing has been performed, and the oil by repose is well separated from the water, the oil is allowed to fall into the drying vat.

This vat is internally of the same form as the preceding one. It is made of wood, and covered internally with tinned metal, or better still, with tin. It contains a close coiled tinned or tin pipe, which receives all the steam which comes from the preceding vat. This vat contains also at the lower part a perforated coil of pipe, which communicates with the blowing engine, and by means of which the air agitation is produced in the oil, which is highly favourable to the drying of the same. It is evident that this drying may be effected in a boiler placed over an open fire; and it is equally obvious that the oil may be agitated by means of any suitable mechanical agent.

The oil after this treatment is in a heated state, but in order to cool the same before filling the casks, the heated oil is caused to flow into such casks through a long length of tin pipe, in the form of a coil or serpentine, placed inside a larger reservoir or tank of cold water. This reservoir or tank may, at the same time, serve to supply the generator. By the aid of a refrigerator similar to the preceding one, and communicating with the lower extremity of the coil inside the drying vessel, all the vapours will be condensed, thereby avoiding the impregnation of the works and immediate neighbourhood with noxious and disagreeable effluvia, which without this precaution would spread in all directions. A distilled water of a high odour is obtained, which is particularly applicable for the washings hereinbefore mentioned, and may be used to the exclusion of all others. By an agitation for the space of from a quarter to half an hour of the oil before the addition of the acid, it will be dried should it be found to contain watery matter.

This drying is rendered much more rapid and effective if the air, before being injected into and through the oil, be dried or freed from moisture in any way, for example, by causing it to pass in the form of small bubbles through concentrated sulphuric acid. The scums are composed of air, strongly acidulated water, and oil. After being allowed to stand for a few hours, they become divided into three layers or strata. The lowest of these consists of a small quantity of acidulated water, the greater part of which is readily drawn off. The middle layer is composed of oil, which should be returned to the agitating vessel before the third agitation; and the top layer or surface is thrown into a sediment vat, where a still further quantity of oil is ultimately obtained from it.

MANUFACTURE OF CAUSTIC SODA.

HENRY DEACON, *Appleton.—Patent dated April* 10, 1862.

THESE improvements consist in stopping the evaporation at an earlier stage, removing the salts precipitated during evaporation as usual, and continuing the evaporation or concentration until the caustic alkaline liquor will deposit crystals of hydrated caustic soda, on cooling to the ordinary atmospheric temperature. These crystals of hydrated caustic soda, after the mother liquors have been separated therefrom, are nearly pure or sufficiently so for commercial purposes. The mother liquors, separated from these crystals, may be used for subsequent operations, or are finished alone. The crystals of hydrated caustic soda thus obtained may be employed for most of the purposes for which ordinary caustic soda is used, it being borne in mind that they contain water of crystallization, and are, therefore, proportionately weaker in soda or "real alkali," than the ordinary fused or solid caustic soda. The crystals may be melted and concentrated by the application of heat should it be desired to obtain fused or a more concentrated form of caustic soda.

These improvements further consist in effecting the separation of the mother liquors from the crystals of the hydrate of soda, which it is preferred to effect by the application of a small amount of heat in any convenient manner, and in any convenient vessel.

The application of heat effects a more speedy, and more thorough drainage or separation of the mother liquor from the crystals of hydrated caustic soda; of course, care must be taken that the temperature of the mother liquors be not increased to such an extent as to redissolve the crystals formed, or as to melt the crystals of hydrated caustic soda in their water of crystallization, and it is preferred to stop the evaporation of the caustic liquors when their boiling point is about 350°. They are then cooled to about 160°, and the clear liquors transferred to the crystallizing vessels, which is best left open at the top during the crystallization. The salts deposited, during this cooling of the liquors, are treated in the ordinary way. A thin hemisphere of cast iron, about six feet diameter, and three feet deep, forms a convenient crystallizing vessel. A hole may be made at the bottom, and provided with a long hollow plug or tube, tapered its whole length, fitting the hole at bottom closely, and raised above the surface of the liquor. In this, or other convenient vessels, the liquors crystallize, and when the temperature of the mother liquor has fallen to about one hundred and twenty degrees, it is removed. In the vessel described, this is effected by withdrawing the hollow tapered plug or tube, first inserting a hot iron into it, or passing a jet of steam into or through it to melt the crystals formed in contact with and adhering to it. The crystallizing vessel is closely covered in, when the mother liquors are removed, and it is also provided with a steam casing or other means of applying heat, so that its contents may be heated to complete the drainage of the mother liquors from the crystals, and with this object the temperature of the crystals is increased to about one hundred and forty degrees. When the crystals are well drained, the heat may be increased until they are melted, and they can then be run into suitable packages for sale, or be concentrated by the application of stronger heat. The mother liquors are added to other caustic liquors, and are re-worked.

APPARATUS FOR THE MANUFACTURE OF IRON AND STEEL.

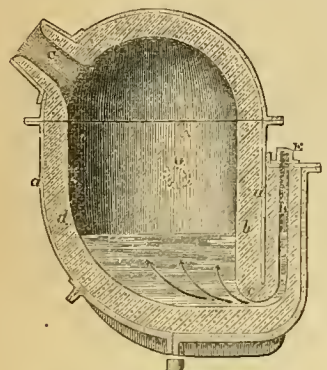
E. B. WILSON, *Engineer, Westminster.—Patent dated May* 5, 1862.

THIS invention relates to the vessel in which the molten metal is treated, during its conversion into malleable metal or steel, and consists in providing such vessel with a central or nearly central exit for the air blast or gases, such exit or escape passage dipping at its lower lip into the molten metal, and extending to within a short distance from the vessel at or near the centre thereof. A space is left round the gas exit passage between its exterior sides and the inner sides of the vessel, with the exception of a portion on one side, which is left to form a convenient outlet for emptying the vessel. Provision is also made for hanging the vessel on centres or pivots at each side thereof. The molten metal having been run into the vessel, air is blown through at one or more separate points of, or entirely round the top space, which air, after passing under the lip, permeates the molten metal, and escapes with the gases up the outlet The tuyere or tuyeres may be made to descend into the metal, or the air may be simply blown down on to the surface of the metal, an air space being left between the surface of the metal and the mouth of the blast pipe. The vessel itself may be of any suit-

able shape, whether *round*, *square*, or oval, and is composed of cast-iron steel plates, or wrought-iron plates, and is lined throughout with good fire resisting material.

Fig. 1 of the subjoined engravings is a vertical section of one modification of the improved converting vessel, made in accordance with this invention, of a circular form, being rectangular in horizontal view. Fig. 2 is a corresponding half plan of the same and horizontal section; and fig. 3 is a similar plan of a slightly modified form of vessel.

Fig. 1



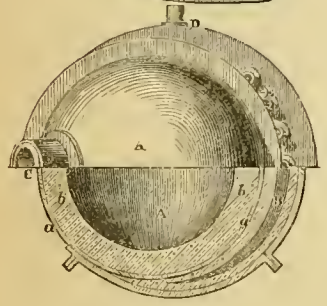
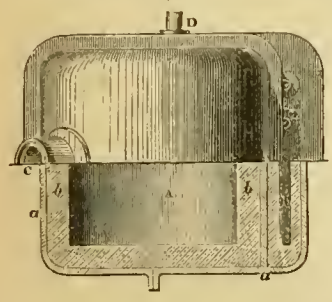


Fig. 2.

The vessel, which is of a circular, or other form, is composed of an outer casing, *a*, of metal, with a thick lining, *b*, of gannister or other good fire resisting material. From this vessel, a little towards one side, rises the main vertical passage or exit, A, for the gases, which is provided at its upper end with a convenient pouring lip, C, for emptying the vessel when turned on its supporting axis or trunnions, D, for that purpose. On the one side of the main vessel is formed a segmental channel, B, for the ingress of the air or gases. This passage, B, descends at *c*, to near the bottom of the converting vessel, A, and dips into the molten metal contained therein, the two parts, A and B, forming together a species of inverted syphon, as shown in fig. 1. One or more blast pipes, E, are fitted into the closed top of the passage, B, of the vessel, which surrounds, or partially surrounds, the exit passage, or main chamber, A, of the vessel. The nozzles of these pipes being made either to dip into the metal or to terminate some distance above the surface of the molten metal, so as to be entirely out of contact therewith. The blast is directed down upon the surface of the metal contained in the space, B, and the pressure causes the level to descend, forcing the main bulk of the metal inside the main chamber, when the air, in the form of a thin sheet, will pass through the curved elongated aperture, under the lip, *c*, and rise as shown by the arrows, in the form of bubbles, through the main mass of molten metal contained in the part, A, the gases and products of combustion escaping by the orifice or open mouth at C. When the blast has been continued long enough, the vessel is tilted on its trunnions, D, and its contents poured out.

Fig. 3.



In the modified form of the vessel, shown at fig. 3, the air space, B, is made on one side only of the exit passage or main chamber, A, in lieu of nearly all round the same as in figs 1 and 2. The air is blown in through one or more blast pipes, E, of any desired section, and it enters the main body of the metal through a straight longitudinal opening left between the lip, e, fig. 1, or lowest portion of the back wall of the exit passage, and the bottom of the vessel.

THE MANUFACTURE OF TINNED LEAD PIPES.

J. H. Johnson, *London and Glasgow* (C. F. Sebille, *Paris.*)—*Patent dated May* 28, 1862.

This invention relates to an improved system of tinning or coating the interior and exterior surfaces of lead pipes made by hydraulic pressure, and consists of a peculiar mode of applying one or more layers or coatings of tin over the lead surface of the pipe, so as to obtain coatings of different thicknesses as desired. This is accomplished by having a reservoir of molten tin placed above the tinning tool, so as to supply the tin constantly thereto. The tin is introduced to the interior of the pipe by an opening in the mandrel, which regulates the diameter of the same; the tin being applied continuously as fast as the tube is made, both to its interior and exterior surfaces. By this system, tinned tubes may be obtained of any indefinite length; while, by the ordinary method, it is necessary to cut the pipe in order to introduce a fresh supply of tin when the first is expended. The thickness of the tinning for pipes of all diameters depends, as hereinbefore stated, on the number of casts or layers of tin, which are applied one over the other, and consequently facility is afforded for applying a covering or lining of tin of any thickness desired.

SHEATHING FOR SHIPS.

James Brown, *London.—Patent dated April* 8, 1862.

This invention consists in protecting the bottoms and sides of ships, and other entirely or partially submerged surfaces, with plates or sheets of iron which have been previously coated or covered with an enamel or glaze either on one or both sides, such glazed or enamelled plates being caused to adhere to the sides and other portions of the vessel desired to be protected by means of a suitable cement, such as marine glue or other adhesive material or mixtures. The plates may also be attached by means of nails, screws, rivets, or other suitable means, but it is preferred to employ adhesive materials as before mentioned, and more especially of that known as marine glue. The enamel or glaze, with which iron or metal plates or sheathing to be employed for the above purposes, are coated or covered, is such as will resist the action of salt or fresh water, and will not easily be detached from the iron or other metal.

In carrying out this invention, iron is selected as the best metal, because the danger of galvanic action is avoided should the plates accidentally come into contact with the sides of an iron vessel. The plates may be of various thickness, but that which has been found most applicable is 24 wire gauge. They may be made of suitable shapes to fit the outline of the vessel, and may be fixed in various ways, either edge to edge or overlapping, as may be found most convenient. But the method preferred and found most effective, is to place them side by side so as to bring the edges of the plates into contact; should there be an interstice it will be filled with the marine glue or other cement employed in fastening them to the ship's bottom, so as to protect the unglazed or unenamelled part from oxydation, the whole being fastened to the vessel or surface to be covered, thus giving to a ship such a surface as will prevent the attachment of animal or vegetable matter, while the pliable nature of the glue in each interstice enables wooden vessels at sea to work without detaching the plates.

LAW REPORTS.

Iron Ships: Clare *v.* The Queen—Infringement.—This was an action in the Court of Queen's Bench, before Lord Chief Justice Cockburn and a special jury. The claim was the first of its kind under Mr Bovill's petition of right act. Mr Clare is the alleged inventor of certain modes of constructing iron ships, and the present action was brought against the Admiralty, for an alleged use and application of his invention, or of his plans and drawings, in the construction of the *Warrior*, and others of our new iron vessels of war.

It is well known that wood preceded iron, and some of the principles of iron building were borrowed from those of wood. In the old system of shipbuilding there were not horizontal beams in the frame, but "stringers," which answered, to some extent, the same object, combined with longitudinal beams at regular intervals. More than 30 years ago, Sir Robert Seppings, then Surveyor of the Royal Navy, introduced a great improvement in the construction of wooden ships,—the combination of vertical ribs in the frame with horizontal beams, "trussed with diagonal timber." This was called Sir Robert Seppings's system of horizontal and diagonal shipbuilding. The bearing of this upon the question of the plaintiff's alleged invention is this, that he alleged that he, in the construction of iron ships, first devised what may be called a self-sustaining framework of longitudinal and vertical beams; whereas, on the part of the Government, it is contended that even while wooden ships were still in vogue, and ever since the introduction of iron ships, that principle or system of construction has been known. So long ago as 1821, a Mr Dickenson obtained a patent for "improvements in the construction of vessels, or crafts, whereby they may be rendered more durable." His invention consisted, first, in the use of more durable substances, as iron or copper; and, secondly, in a new arrangement of the parts, both as to the form and the means of framing and uniting them together, suited to the materials so adopted; his mode of construction being the forming the sides of the vessels of shallow iron boxes, formed so as to suit the shape and size of the vessel, the largest surfaces forming what in a wooden vessel would be the planking, while their sides form flanges by which such boxes are

united together by rivets, or bolts and nuts. Then in 1843, one Guppy took out a patent for certain "improvements in the building of metal ships," one of which consisted in "the construction of false internal sides and bottoms to metal ships, made of sheet iron," in which "the ordinary made of using angle or T-iron" might be adopted. In 1845 one Boydell took out a patent for "improvements in building of ships," his invention being described as consisting of "a mode of building ships with iron," and in which the ribs of the vessel were made with angle iron, and to the inner surfaces of the ribs plates of iron were to be fixed with rivets, the spaces between the ribs being filled with wood. Another patent, about the same time obtained by James Boydell, jun, was for improvements in the joining of sheets or plates of metal, one of which consisted in the employment of grooved iron rafters in combination with plates of iron, the edges of which were caused to enter the grooves. In 1846, Mr Fairbairn took out a patent for improvements in the construction of iron beams for the erection of bridges and other structures, his improvements being described as consisting in the novel application and use of plates of metal united by means of rivets and angle iron for such or similar purposes. In 1847 the Britannia iron bridge was being constructed, which was completed in 1850, when a book describing it was published. In September, 1853, the plaintiff filed his provisional specification for "improvements in the construction of iron vessels, &c.," his invention being described as relating to a novel mode of attaching iron plates in erecting structures requiring a skeleton or framework, such as ships and the like; and, secondly, to another mode of attaching iron plates to each other without any framework, suitable for such structures as boilers, masts, and the like. And the plans he detailed were, he stated, to have reference more directly to iron shipbuilding, but might be modified for other structures. "In the construction of iron vessels," he stated, "I recommend that the iron framework should consist mainly of longitudinal frames of flat bar iron, crossed by vertical frames or ribs." And "having described several methods of carying out his improvements," he stated that he did not restrict himself to any particular form, dimensions, or use to which structures or articles might be applied when made on the principle of his invention; but he claimed—1, the peculiar modes of fastening iron plates in the construction of vessels, &c.; 2, the methods of attaching iron plates in the manufacture of smoke funnels, masts, and similar structures and articles. In March, 1854, the plaintiff filed his specification with the same title, and the same general description of his invention. In the detailed description of it there were, however, certain differences which it will be seen were relied upon on the part of the Government as so enlarging his claim of invention as to vitiate his patent. These details included a "method of sheathing flanged iron plates with wood for copvering," "and a plan of deck-planking," and a plan of wood sheathing over flanged ribbed iron plates. Then the specification concluded thus:—"Having thus described the nature of my invention, I would observe that I sometimes use iron plates with the flanges turned inwards, or angle or T-iron, and rivet through them, thus producing a smooth external surface; or employ iron plates alternately grooved and tongued at the edge, thereby enabling me to produce two smooth surfaces; and articles thus made may be held together by hoops or bands for strength. And when the articles or structures require casing with wood, I turn the flanges outwards to receive the wood, and sometimes they may be coated with iron, the wood then being internal. I desire it to be understood that I do not confine myself to the precise form or uses to which my improved plate and bar iron may be applied, my invention being applicable to various other manufactures, as pontoons, caissons, &c. I am aware that wood sheathing and ribbed plate iron have already been employed; I therefore restrict my claim to my own particular arrangements thereof. And I declare that what I claim as my improvements are—1, the peculiar modes of fastening iron plates to each other, and to the various kinds of framework or skeleton in the construction of vessels or other structures requiring such framework; and 2, the various modes of fastening iron plates to each other where a framework is not required." The claim, it will be observed, was identically the same in terms as that in the original or provisional specification, the variations being in the detailed descriptions. Such having been the patent obtained in march, 1854, by the plaintiff, certain communications took place between himself and the Admiralty between that time and June, 1854, the nature and effect of which, of course, formed one of the matters in dispute. It was alleged on the part of the plaintiff that the correspondence between him and the Admiralty amounted to a contract by that department to use and pay him for the use of his plans. This they denied, and all that can be stated as not in dispute is, that the Admiralty having invited shipbuilders to send in designs, the plaintiff sent in his along with others, and those builders who sent in what the Admiralty considered the best designs were employed to build the new vessels. Between Feb., 1856, and July, 1860, divers vessels were constructed by the Admiralty, in which, as he alleged, his invention had been used and applied. And his claim was thus stated in his "particulars." The *Erebus*, the *Terror*, the *Thunderbolt*, the *Warrior*, the *Resistance*, the *Black Prince*, the *Defence*, these were described by the plaintiff as "vessels of war, gunboats, and floating batteries, constructed by the Admiralty according to the plaintiff's designs, models, drawings, tracings, and explanations, or with the aid, use, and application of his patented invention." On the part of the Admiralty any such claim on his part was from the first repudiated. As a matter of fact, the plaintiff had in the interval between his patent and the construction of these vessels sent in certain plans and drawings, &c.; and in 1860 he made certain claims upon the Admiralty, grounded upon their supposed use of his drawings and his invention. The Admiralty denied the use either of his drawings or of anything which could fairly be considered as his invention, and this was the question now raised. The petition of right was filed so long ago as March, 1861, framing his case not only upon his patent, but also on a second and distinct count,—upon an alleged contract by the Admiralty to accept and use his plans and remunerate him for their use; and particulars of infringement were then delivered, which comprised "longitudinal framing on each side of internal keel," and "plates of vertical framing set up according to the invention," "vertical floors," and in short—"1, longitudinal framing, inside and out; 2, mode of securing timber to external framing; 3, a particular mode of framing in floors; 4, timber between two thicknesses of metal: and 5, tonguing and grooving plates." It will be seen that most of this relates to the framing, and a good deal of it to the union of the wooden work with iron, and two main points in dispute were whether these were included in the alleged invention, and if so whether they were novelties, so that they could legally be the subjects of a patent.

After the examination of the plaintiff or suppliant, and the witnesses on his side, the Attorney General opened the case for the Crown.

Mr Carpmael, was called and examined by Mr Collier, Q.C., at great length, on the part of the Crown. According to his evidence, in the plaintiff's process the rivets pass through the angle or "T" iron and the iron plates, and must do so; and that the plates were necessary to keep the "angle iron" together, and the rivets to keep the plates together; and that without them the "skeleton plates" would not hold together, and would fall to pieces. The plaintiff, he said, in his complete specification, claimed matters which were not in the original specification, and were not new. According to his view, the complete specification claimed the putting of wooden decks on transverse bars of iron, which, he said, had been practised 20 years before the patent. There was nothing, in his opinion, in the plaintiff's pateut which could include armour-plates like those of the *Warrior*. The most interesting portion of his evidence was that which related to the construction of this noble vessel, with a view to show that it was not made according to the plaintiff's plan. As to this, the sum and substance of his evidence seemed to be that, on the plaintiff's plan, there would be no independent framework apart from the plates which formed the "skin," as the edges of the iron plates, according to the plaintiff's plan, are fastened to the frame and hold the frame together, so that there would be no frame without the plates; whereas, in the Admiralty plan (on which the *Warrior* was constructed), the edges of the plates are fastened simply to each other, and fastened together by means of overlapping and riveting, and the plates are then riveted to the "skin" of the ship; in short, the "skin" is one body, and the frame is another, attached to each other, but independent, so that, without the framing, the "skin" would hold togetber; whereas upon the plaintiff's plan the "skin" would not hold together without the framing, and the "skin" and the framing are mutually necessary to each other, and the rivets are necessary to keep the whole together. In fact, the witness said, the *Warrior* is a complete body without any frame, the plates being joined together by riveting and overlapping, and, though there is a longitudinal beam, that is not the means of connecting the plates together, but is only the mode of connecting the "skin" with the main body. In the *Warrior*, he said, there is no "T" iron (although there is angle iron), and the mode of armour-plating, he said, is essentially different from the plaintiff's method, which, indeed, he denied had any proper application to armour-plating at all. In the *Warrior* the wood was only between the "skin" and the armour, and the mode of arrangement was quite different from that described by the plaintiff. The witness denied the novelty of the plaintiff's method, and declared that the essential features of the *Warrior* plan were to be found in the construction of the Britannia bridge at the Menia Straits, and that other portions of the plaintiff's method were to be found also in that bridge. The "T" angle iron, for instance, was to be found in that bridge, and if the plaintiff claimed the longitudinal and transverse frames without riveting, then that was to be found in the bridge, which contained some features of construction to be found in the *Warrior;* and some which were not in the *Warrior*, but were in the plan of the plaintiff. There were other iron bridges which illustrated the same system of construction, as that of the Conway. It was, the witness said, well known to scientific men throughout the country long before the plaintiff's patent. After the Britannia bridge was finished, a work was published in 1850, with diagrams, fully explaining it; and any one reading it would quite master the whole system of horizontal and vertical framing, and, in fact, all the main features of the plaintiff's or of the Admiralty plan.

Sir Charles Fox was the next witness called on the part of the Crown, and examined by Mr Lush, Q.C., somewhat to the same effect as Mr Carpmael.

In answer to the Lord Chief Justice, the witness stated that it would be difficult to apply the plaintiff's plan to a frame already existing, or without the use of rivets and plates, which must neeessarily be combined. According to the plaintiff's plan, longitudinal beams, vertical beams, and plates were all held together by the same rivets, so that framework and plates were not separate self-supporting systems. There was nothing in the specification to indieate an independent longitudinal and vertical framework, where, as in the *Warrior*, it was quite otherwise.

Sir Charles Fox went on to say that the plaintiff had shown him his drawings, &c., and that he had told him in 1853 there was nothing new in tbem, and, he repeated, there was nothing new in them.

The Lord Chief Justice.—Supposing the *Warrior* had been built as it is before the plaintiff's patent in 1853, would it have been new?

Sir Charles Fox —No; every part of her would have been already anticipated by some invention or another. So long ago as 1831 he knew of an iron ship built as the *Warrior* was, with an independent framework of longitudinal and vertical bars and "angle" iron ribs, connected with rivets, the frame being capable of eompletion before the plates were put on, and itself being independent. That ship was built by the late Mr Laird for the purpose of a voyage for the exploration of the Niger. Since then ships had been constantly so built, and he had never, in truth, known an iron ship bu lt otherwise. And there was nothing either in the plaintiff's patent or the plan of the *Warrior* which could be ealled "new" in 1853.

The Lord Chief Justice addressed the jury, and concluded a very elaborate argument by asking the jury to consider—first, what was the true nature of the petitioner's patented invention as described in the text and drawings eontained in his specification; secondly, supposing them to come to the conelusion that his patent was what he asserted it to be, did he properly describe it in his speeifieation? thirdly, was the petitioner antieipated by others in his alleged invention? fourthly, was there a material variation between the provisional and the complete speeifieation? It would also be the duty of the jury, his lordship added, should they find for the petitioner, to settle the amount of the damages. He himself could give them no adviee on that point, and he was somewhat surprised that the learned council for the petitiouer had never alluded to the subjeet in his speeeh.

The jury then retired, and after a lengthened deliberation, returned into court with a verdiet for the Crown.

Mr Digby Seymour, Q C., Mr Denman, Q.C., Mr Webster, Mr J. A. Russell, and Mr Best were for the "suppliant," or plaintiff; Sir William Atherton, Attorney-General, Mr Collier, Q.C., Mr Lush, Q.C., Mr West, and Mr Macrory were for the Crown.

Manufacture of Chenille: Davenport *v.* Jepson—Infrinoement.—This was an action for infringement of the plaintiff's patent for improvements in the manufacture of Chenille, and was tried before Viee-Chancellor Sir W. P. Wood. The validity of this patent was disputed by the defendants (who have been restrained by an *interim* injunction from the sale and manufacture of chenille by their machines), upon the grounds of want of novelty and originality, vagueness of specification, and publication of the invention by the patentees prior to their obtaining the letters patent. The interest of the case, exeept to the trade, is by no means in proportion to the time occupied, and would not have justified a report *de die in diem* of the evidenee given, a large portion of which has been of the most teehnical charaeter, and only intelligible by the aid of the models, diagrams, &e. The evidence was of a most voluminous charaeter, the business oceupying eight days.

The Viee-Chancellor having summed up,

The jury retired at 12 o'clock to consider the verdiet.

Shortly after 3 o'clock a eommunication was reeeived from the jury to the effect that there was no chance of their agreeing.

The Viee-Chancellor sent to inquire if any further direetion on his part could assist them to a verdict. He proposed to return into court at 6 o'clock, and leave them until then to consider their verdict.

The jury upon this message returned into court and stated that they were agreed upon all but one of the issues, which involved the whole ease, but that there was no ehance of an agreement upon that.

The Viee-Chancellor, after observing that he was very much grieved that the parties should have been put to this very great expense in vain, said that he should follow the preeedent of "Hudson *v.* Slade" (where the jury had been discharged after three hours' deliberation), and discharge the jury, neither party opposing.

It was intimated by the learned eounsel on both sides that if they did not oppose they did not consent to this course being taken.

Mr Willeock, Mr Serjeant Mayes, Mr Hardy, and Mr T. Webster (Common Law Bar) were for the plaintiffs; Mr Rolt, Mr Karslake, Mr Theodore Aston (Common Low Bar), and Mr F. J. Wood for the defendants.

Photographic Copies of Engravings: Gambart *v.* Ball—Infringement.—This was in the Court of Common Pleas, before Lord Chief Justice Erle and Justices Williams, Willes, and Keating, and followed upon an action tried before Mr Justice Willes at the last sittings at Guildhall, when a verdict was found for the plaintiff—Damages £10.

Mr Coleridge, Q.C., now moved on leave reserved to enter a nonsuit, on the grounds that there was no evidence to go to the jury, and that there was no infringement of any Aet of Parliament. The question arose on the right to publish photographic eopies of certain prints, and whether so doing was an infringement of the Copyright Acts. The plaintiff was the proprietor of the prints, the "Horse Fair," engraved from Rosa Bonheur's picture, and of "The Light of the World," engraved from Hunt's picture. The defendant, among other photographic scraps, had sold a copy of the print, the "Horse Fair," and also a photographic copy of the other print, and the jury found that they were eopies taken from the engravings themselves. The learned eounsel contended that these photographic copies of the prints in question would be no infringement of the plaintiff's copyright, unless within the words of the Copyright Acts. The first of these Acts was the 8th George II., cap. 13, which gave any person who invented a design, or engraved or etched it, the sole right and liberty of priuting it for 14 years. This was to protect the artist or inventor of a picture. The next statute was the 7th George III., cap. 38, which extended the provisions of the former statute by prohibiting any person to engrave, print, or publish, or import for sale, any copy of a print in which any person had a eopyright.

Mr Justice Willes.—That is a protection of engraving against engraving, not of engraving against drawing; *a fortiori*, uot against a new mode of drawing.

Mr Coleridge.—That was so. The next statute was the 17th George III., chap. 57, which prohibited "that any person should engrave, etch, or work, or in any other manner copy in whole or in part, any print in which there was a copyright." This statute, the learned counsel contended, did not extend the protection against any other kind of piracy than that which before existed. The next statute was the 6th and 7th William IV., chap 59, which extended the provisions of these Acts to Ireland. The last statute was the 15th and 16th Victoria, chap. 12, which by section 14, extended the protection of the Copyright Acts relating to prints against lithographs or any other mechanical process by which prints or impressions of drawings or designs are capable of being imitated. The learned eounsel submitted that photographs were not within the meaning or protection of any of these Aets, nor was a word said about photographs in the treaties regarding international copyrights. —Rule *nisi* granted.

Statuary Copyright: Smith *v.* Reynolds—Infringement.—A curious ease was heard at the Liverpool Poliee Court on Saturday, in which Mr Smith, sculptor, of Mount Pleasant, Liverpool, was the plaintiff, and Mr Reynolds, proprietor of waxworks, Lime Street, Liverpool, was the defendant. Mr Smith, about the middle of last year, modelled a bust of Tom Sayers, and had his eopyright registered. Some person in Liverpool gave Reynolds a eopy of the bust, from which he east several "pieeed" busts, and, as it was alleged, sold about forty copies, thereby injuring the plaintiff's work. The magistrates inflicted a penalty of £20 with eosts.

Trade Marks, Models and Designs.—The Commereial Treaty with Belgium, which has been published recently, contains the following stipulations:—Artiele 16. The subjeets of one of the high contraetiug parties shall enjoy, in the dominions of the other, the same protection as native subjeets in all that relates to property in trade marks, as well as in industrial and manufaeturing patterns and models of every description. The exclusive right to make use of an industrial or manufaeturing pattern or model shall not, with regard to British subjeets in Belgium, and reciprocally with regard to Belgian subjects in Great Britain, have a duration longer than that fixed by the law of the country for native subjeets. If the industrial or manufacturing pattern or model is open to the public in the country of origin, it eannot be made the subjeet of an exclusive right in the other country. The rights of subjects of one of the high contraeting parties in the dominions of the other are not subject to the condition that the models or patterns shall be worked there. The present article shall not be put into operation in either country, with regard to such models or patterns, until the expiration of a year from the date of the signature of the present treaty.—Article 17. Belgian subjeets shall not have the right to elaim in Great Britain exclusive property in a mark, model or pattern, unless they shall have previously complied with the regulations, if any, which are or may be in force for the deposit at London, by British subjects, of marks, models or patterns (*dessins*). Reciproeally, British subjeets shall not have the right to claim in Belgium exclusive property in a mark, model or pattern, unless they shall have previously complied with the laws and regulations on those subjects which are or may be in force in Belgium.

REVIEWS OF NEW BOOKS.

A Practical Treatise on the Law Relating to Mines and Mining Companies. By Whittou Arundell, Attorney-at-Law. Loudon: Lockwood & Co. 1862.

The intention of the author of this little book, as stated by himself in his preface, has been to "produce a work which, whether placed in the hands of a lawyer or a layman, might be found alike serviceable." This intention has been successfully carried out. The book contains valuable information as to the chief points of the subject on which it treats, and, so far as we bave been able to judge, the law relating to mines and mining is accurately stated. Of course, in a work of this character, it would have been impossible to have given anything like a digest of all the decided cases, or to discuss every one of the many questions of mining law which must arise in daily practice; indeed, the author admits that his book is addressed, not so much to the lawyer, as to the general reader. We forbear, therefore, from too minute a criticism of the work as a legal text book, but it must be remembered that while the author appears to have shown considerable judgment in the selectiou of his cases for illustration, and to lay down no proposition for which he does not produce authority, he has omitted several cases, which, in a work intended for the guidance of the legal profession, ought to have occnpied a conspicuous place. Such, for instance, is the great case of Chasemore *v.* Richards, decided by the House of Lords in 1859, in which the whole subject of the right to underground watcr was fully and completely discussed; and the doctrine that the surface owner has no remedy against persons who divert from his land undergrouud water, flowing in no definite channel, was firnly established. This doctrine, indeed, is so stated by the author, but on the authority of an earlier case, which was decided by au inferior court. The practitioner, however, would, very properly, expect to be furnished with the latest and highest authority for every proposition advanced. With this reservation, the hook will, we think, be useful to the lawyer, for it appears to have the merit of heing accurate as far as it goes; while we can confidently recommend it for the general reader, for whom, as we have said, it is primarily designed.

Among the numerous subjects discussed in this volume, are—the nature of the property in mines, the transfer of such property, the constitntion of mining companies (and herein of the cost book principle), the working of mines, including the rights of surface owuers and adjacent landowners, questions of injury and nuisance, and of the rights of water and of way, so far as they affect mining operations, criminal offences connected with mines, such as drowning, or setting them on fire, larceny of minerals, etc., and the rating of mining property. There is also a chapter on the Court of the Stannaries, which, as onr readers may know, is a court of high antiquity, dating back to the reign of Edward I., aud established for the administration of justice in all matters relating to the Cornish and Devou mines. The work also contains a chapter on the formation and constitution of joint stock companies. An appendix is added to the volume, containing some precedents relating to mining cases, and also the statutes by which the jurisdiction and practice of the Court of the Stannaries are now governed. Our readers will see by the above abstract that the work is one which must have cost the author uo slight labour; and we trust that he may find, by the fact of a second edition of his hook heing soon required, that his industry has been appreciated by the miniug public.

Phosphorescence; or, the Emission of Light by Minerals, Plants, and Animals. By T. L. Phipson, Ph.D., F.C.S., &c. 8vo. London: Reeve & Co. 1862.

This is a very readable little book for the milliou, that likes to sip scientific novelty and wonder, without much trouble, or thought beyond amnsement, and may form a useful basis for a future more complete work on the subject, either by the author, or his succcssors.

We can scarcely say, however, that he has thrown much light upon what, by a ratber odd coucurrence of words, may be called a very obscure region of light; nor even diligently and exhaustively looked up aud noticed all the facts already on record, belonging to his subject.

For example, we have looked in vain for any notice in his book, of certainly one of the most remarkable instances, of what is *strictly* to bc called phosphorescence, that has ever been observed.

The late M. Mauricc Scanlan remarked that, when a saturated hot solution of nitrate of strontian was left to cool and crystallise in an earthenware vessel, as each crystal shot iuto a solid prism in the liqnid, which was placed in the dark, a brilliant flash of light took place, and disappeared, leaving the new-born crystal dimly luminous for a second or two. He published an account of this in British journals; and it may be found noticed in Gmelin's great systematic work, where nothing, however minute, is omitted.

The author, in his preface, defines phosphorescence as "the spontaneous emission of light hy natural or artificial *substances*, as well as hy living and dead organic hodies." We confess we dou't like the definition; if a glow-worm have the power to shine or not, at will, his light may be *spontaneous*, but how the word can be correctly applied to light emitted, or not, from hodies without life or will—the subjects merely of physical cause and effect—we cannot see; nor does *substance* appear the word to apply to the adjectives "natural or artificial." If, however, we accept the definition, our author seems himself to wander sadly outside its limits, and, indeed, includes in his catalogue of phosphorescent bodies, some, for example "falling stars," or "aerolites," in which we feel satisfied, physicists in the existing state of science, will not follow him.

Wherever mechanical force is converted into heat, as in the flying through the resisting air, of a projectile or a meteoric stone, heat is evolved in the body acting, or acted on; and at a certain point of temperature, light is evolved also; hut, this is not phosphorescence, as we understand the proper significance of the term. Its use should be limited now, to such evolutions of light as we cannot refer, in way of cause, directly to chemical change of properties, or physical change of volume. Thus, strictly, the luminosity of fresh cut potassium, is not phosphorescence; nor is that of tallow at its boiling point (another fact the author does not, we think, notice); nor that of phosphorus itself, at low temperatures; but simply cases of slow combustion, attended with a low evolution of light; and to this category, we suspect, a large number of phosphoric facts already observed, if duly colligated, might be referred.

Phosphorescence is, at any rate, *most* properly confined to such phenomena as the following extract describes, which gives a good idea of the author's style and matter:—

"Luminous Flowers.—The latest aud, at the same time, most authentic observation of luminous flowers that has been made, is the following: On the 18th of June, 1857, about ten o'clock in the evening, M. W. Fries, the well-known Swedish botanist, while walking alone in the botanic garden of Upsala, remarked a group of poppies, in which three or four flowers emitted little flashes of light. Forewarned, as he was, by a knowledge that such things had been observed by others, he could not help believing he was suffering from an optical delusion. However, the flashes continued, showing themselves from time to time during three-quarters of an hour. M. Fries was thus forced to believe that what he saw was real. The next day, observing the same pheuomenon to re-occur at about the same hour, he conducted to the place a person entirely ignorant that such a manifestation of light had ever been witnessed in the vegetable world; and, without relating anything concerning it, he brought his companion before the group of poppies. The latter observer was soon in raptures of astonishment and admiration. Many other persons were then led to the spot, some of whom immediately remarked that "the flowers were throwing out flames."

The author is (if we mistake him not for another) also that of a paper on the phosphorescence of the Raie (Fr) or Ray Fish, published in the *Comptes Rendu*, T. 51, p. 546, for 1861, of which we find not any notice in this book. One of the most complete and classical monographs, upon animal phosphorescenee, ever produced, was that read several years ago by the late Sir Henry Marsh, Bart., to the College of Physicians in Dublin; we are not aware that it has ever been published.

Dr Phipson concludes his book, with a chapter on the theory of the phenomena which he has collected and described. It scarcely admits of condensed quotation; aud as we could uot endorse his views, so far as we understand them, we had best leave them to those who read the book itself.

Phosphorescence, and, in general, the relations, physical and chemical, that are connected with the inceptive evolution of light, are a promising subject to the experimentalist; and science seems quite ripe now for the pursuit, with advantage. Those engaging in it will, uo doubt, employ this little work, at least, as a large magazine of collected knowledge.—Ed.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

Sir,—Has an apparatus for supplying the steam engine cylinder with grease, through the steam pipe, ever been employed? The grease poured into a vessel, fitted with necessary cocks and glasses, thence forced by the pressure of the steam into the pipe, in small jets, aud carried by the steam into the cylinder for lubrication.—Yours, etc., etc.,

A Constant Reader.

[We don't exactly understand the details of arrangement you propose,—so far as we do, it seems to us that very analogous methods have been already in use.]—En.

CHIMNEY TOPS.

I have just succeeded in curing an obstinate smoky chimney, by the aid of a zinc covering outside a common earthenware chimney pot, having two openings in the zinc, one east, and the other west. There are also two partitions or stoppers, north and south, to prevent the draught from escaping by the opposite opening.

Fig. 1.

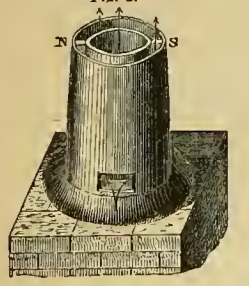


Fig. 2.

The accompanying sketches represent, in fig. 1, a perspective view of the arrangement; and in fig. 2, a horizontal section of it.

By the aid of this contrivance, an upward current of air is carried outside the flue, to its top, on the windward side of the chimney.

I have now had the plan in use some time; and in the face of several most violent storms, not a particle of smoke or soot has come down the flue. In other rooms, the soot was blown on to the floor to a large extent.

C. Butler Clough.

Llwyn Affa, Mold, February, 1863.

TEXTILE FIBRE FROM HORSE RADISH.

I take the liberty of sending you enclosed a sample of vegetable fibre obtained from the leafstalks of horse radish, which may prove of some use during the present famine for the raw materials for manufacturing purposes. My attention was first drawn to it about six years ago, and I have made every effort to introduce it into notice amongst Aberdeen manufacturers, without effect for four years. You will observe that the fibre is of the natural grey colour, having undergone no process of bleaching. The leafstalks are simply steeped in stagnant water for four weeks, which softens them so that the pulp can be easily separated from the fibre with the hand. It is then repeatedly and carefully washed with cold water, and dried in the sun.

The colour and quality can, no doubt, be easily improved by the usual process adopted with similar productions. The quantity of fibre in the stalk is really enormous, and the radish can be cultivated with the greatest ease to any extent in our own country. From the patch of land which I have cultivated, not much exceeding a "fall" (36 square yards), my calculation of the produce of an acre would not be much under two tons.

George Middleton.

Feddcrat, New Deer, Aberdeenshire.

[The sample of fibre which our correspondent has sent us is of remarkably long staple, of great strength, and good colour. Indeed, on this last point, Mr Middleton remarks that the natural colour presents such a fine, silvery, metallic lustre, preferred by many people to pure white, that it is questionable if bleaching would be any improvement. We think there is no doubt as to the excellence of the fibre for certain purposes, but whether as a substitute for cotton is extremely doubtful. —Ed.]

CAPTAIN NORTON'S IMPROVEMENTS IN GUNNERY.

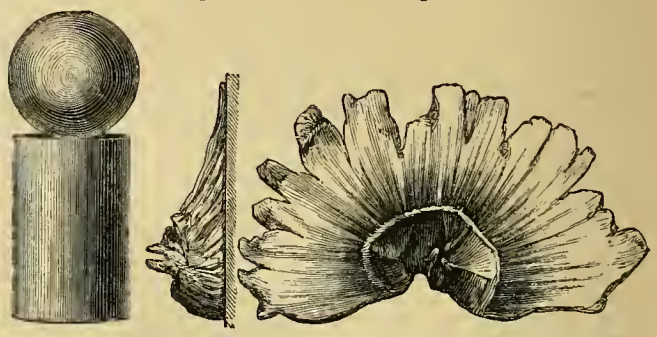
I am now satisfied that my plan of casting cannon ready bored and rifled, in the *act of casting*, will come into governmental use; the Americans, I perceive, are quite alive to the advantages of the process, and are casting rifled guns according to it. The system which I prefer is that of the oval bore spiral.

I see also, that the Austrians are now using gun cotton in a most satisfactory manner, and I understand that they have got a superior metal for casting cannon, which appears to me to be well suited for casting after my model—it is bronze with a small admixture of iron.

There is no doubt, in my opinion, that the oval spiral is the best form of rifling to give "spin" to both spherical and elongated shot—a wooden or other tough sabot can be used in front and rear of the round shot, to impart the spiral motion. I have also just had a request from London, Canada West, for information as to my mode of discharging my cartridges when inserted in a stone or a tree stump so as to insure safety to the operator, and must refer to your *Journal*, for the drawings of the whole arrangement. (See page 195 *Practical Mechanic's Journal*, vol. 6, First Series.) The round ironbar inserted over the cartridge, may be made somewhat smaller in diameter than the end which is drawn home upon the cartridge; by the fall of the plank this smaller end answers for driving or raming the cartridge down to the bottom of the hole, before the igniter or phlogistic pill is dropped in, so as to rest on the head of the cartridge. I have now accomplished and established as a great fact the discharge of elongated and round shot from the same rifled cannon.

My annexed sketches illustrate my views, I think, very clearly. Fig. 1 is a view in elevation, fig. 2 is a profile of the centre of the fired bullet,

Fig. 1. Fig. 2. Fig. 3.



and fig. 3 is a corresponding front view of the same. There are no marks upon the bullet, thus proving that the rifled sabot is the "turn-snit."

John Norton.

Bray, Wicklow, *Feb.* 1863.

MECHANIC'S LIBRARY.

Art Copyright, Law of, 12mo, 7s 6d, cloth. Underdown.
Compass Rectified by Azimuth and Altitude Tables, 7s 6d. Cameron.
Industry in Ireland, 8vo, 3s. sewed. Crory.
Mathematical Geography, Compendium of, post 8vo, 5s, cloth. Dick.
Photography on Glass and Paper, Part I. 5th edition, 1s cloth.
Sailing Boat, 3d Edition, post 8vo, 12s 6d, cloth. Folkard.
Signals, Commercial Code of, 8vo, 10s, cloth. Larkins & Mayo.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS, MANCHESTER.

At a special meeting of the Executive Committee of this Association, Mr L. E. Fletcher, chief engineer, presented his annual report, relating to matters of an engineering character, from which the following facts are extracted.

It appears that all the boilers under the care of the Association have received their full complement of examinations during the past year, including an annual visit of inspection from the chief engineer; while the report goes on to say, "820 of these boilers have been examined 'Thoroughly,' that is, when empty and cold, when the inspector not only gets inside them, but also goes up the flues, so as to ascertain the condition of the plates and seams of rivets throughout. The number of these examinations this year is higher than it has been in any preceding one since the commencement of the Association, and is nearly double that of last year." In consequence of this increased number of "Thorough" examinations, it was stated, that a larger number of defects than usual had been revealed, and which would otherwise have been unknown; an additional illustration of the importance of these examinations. "The defects discovered in boilers are mainly of two classes, one relating to their Construction, and the other to their Condition. Under the first head, namely, that of Construction, 196 recommendations had been made, which are as follows:—

"In 153 boilers the internal flue tubes have been recommended to be strengthened by hooping.

"In 18 boilers the shells have been recommended to be strengthened at the steam domes by stays of angle iron, &c.

"In 9 boilers the shells have been recommended to be strengthened at the ends.

"In 16 boilers the load on the safety valves has been recommended to be reduced."

Under the second head, namely, that of Condition, 85 defects had been discovered, all of which were considered dangerous, they are as follows:— "Fracture of Plates and Angle Irons, 13; Blistered Plates, 1; Furnaces out of Shape, 12; Corrosion, 37; Defective Safety Valves, 5; Defective Water Gauges, 9; Defective Blow-out Apparatus, 7;" others not actually dangerous, but still unsatisfactory, were then given, which need not here be repeated. The report then went into a detailed consideration of the defects discovered under each of the above heads; some of the remarks on Corrosion may be given.

"Corrosion is found to be going on in all boilers more or less, and it will be seen that the greatest number of dangerous defects in the preceding table are to be found under this head."

"In one case a boiler set upon a mid-feather wall 15 inches thick, had a channel eaten right along it about 8 inches wide, which ran down the centre of the seating, while the plates at the edges of the brickwork appeared quite sound, and the danger consequently passed for some time unsuspected. In a second instance, with a mid-feather 2 feet wide, the plate was found to be eaten almost through from nearly one end of the boiler to the other—while in a third, where lime had been allowed to come in contact with the boiler at the mid-feather, the plate was completely pulverised and could be carried away in handfuls. In a fourth case, a vertical tubular boiler had been placed close to a wall, one part being in actnal contact. Damp in the brickwork set up a corrosive action in the plate, which being concealed by the position, went on undetected nntil the metal was completely eaten through, and a piece blown out by the pressnre of the steam. The original plating of the boiler was thick, the pressure low, and the corrosive action local, only affecting a surface of about 12 inches square, so that the rent did not extend."

"Examples of corrosion might he multiplied indefinitely; enough, however, has heen said to show the importance of having all parts of the boiler accessible to examination, the flues snfficiently capacious, and the seatings as narrow as possible, and also of having the brickwork removed occasionally, at all events in places, so as to ascertain the condition of the plates, since to conclude that the parts concealed are in the same condition as those in view has heen found in practice to be fallacious."

Under the head of Explosions it was stated:—"It is to be regretted that no means exist of ascertaining the whole number of steam boiler explosions that occur throughout the United Kingdom, and there can he no doubt that many are never recorded at all. There are known, however, to have occurred dnring the last year, no less than 31 explosions, from which at least 87 persons have been killed, and 88 injured. Of the number of lives lost by some of the above, no acconnt could he obtained; while from one of them, as many as 29 persons were killed and 12 injured; from a second, 12 were killed and 24 injnred; and from a third, 6 were killed and 8 injured."

The following list gives the description of boiler to whieh the explosions have occnrred, with the nnmher of each class, as well as of the persons killed and injured:—"4 Haystack Boilers—12 persons killed and 5 others injured; 6 Plain Cylindrical Egg-ended Boilers—6 persons killed and 6 others injured; 3 Iron Works Boilers—47 persons killed and 44 others injured; 3 Plain Single-flned Cornish Boilers—2 persons killed and 2 others injured; 2 Plain Double-flued Lancashire Boilers—4 persons killed; 3 Locomotive Boilers—4 persons killed and 2 others injnred; 1 Agricnltnral Boiler of Tubular Portahle Constrnction—4 persons killed and 4 others injured; 1 Kitchen-range Boiler—1 person killed. Also 8 other boilers, of the construction of which no reliable information could he ohtained—but from the explosion of which 27 persons were killed and 22 others injured."

In onr report of this Association last month, it should have heen stated that the statistical returns given in the first paragraph, refer to the year 1861. The reader has thus before him the results of the months of December, 1861, and 1862.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

January 13, 1863.—Mr Spence hrought under the notice of the society a specimen of the metal magnesium. This metal has hitherto been produced only in small quantities, by means of sodium. The specimen shown derived its interest from the fact that it is stated to have been produced by direct rednction, either from the oxide or some of its salts. If this information, which has been ohtained througb a friend of the inventor, proves eorrect, it is a matter of considerable importance, as the metal has most valuable qualities.

Professor Roscoe read the following extract from a letter which he had just received from Professor Bunsen, respecting the properties of metallic rubidium:—"I have prepared metallic ruhidium by reduction with earbon in an iron vessel; from 75 grammes of the hitartrate of rubidium I ohtained 5 grammes of the metal in coherent masses, one of which weighed 3 grammes. Rubidium closely resembles potassinm in its properties, its vapour possesses a greenish blne colour, the specifie gravity of the metal is 1·65, it is more electro-positive than potassium, and it melts at the very low temperature of 38·5° C."

Mr Edward Hnll "On the Age of the New South Wales Coalfield."

Dr Jonle described a peculiar kind of mirage which he had witnessed from the northern extremity of Douglas Bay, Isle of Man.

Microscopical Section.

December 15, 1862.—Mr J. G. Lynde stated that he was led to pursue Dr Roberts's snggestions on the use of magenta dye in examining tissues. From experiments made since the last meeting of the Section, he finds that the dye has no power to colonr living tissue, whether animal or vegetahle, hut that as soon as life is extinct the aetion of the dye commences.

Mr Leigh drew the attention of the Section to the adulteration of size as a eanse of mildew in eotton goods.

Mr Watson referred to the investigations made by Mr Thomson ahout twenty-five years ago, as to the eause of mildew in madder purple-printed cottons shipped to hot climates. It was attribnted to the starch employed in finishing the goods, which, aeted upon by moisture, heat, and pressure, had given rise to an organic acid which discharged the colour.

Mr Hurst described his experience of mildew on printed eottons and upon dyed fnstians, at Gibraltar and Calcutta. In most cases it appeared in spots and ronnd patches, which affeeted the colours. On the fustians, he had no donbt it was cansed hy tbe growth of a fungus, as the surface of the spots was sensibly raised.

Mr Mosley considered there might be several kinds of mildew; that upon the fnstians might be attrihnted to the bone size with which these goods were generally finished, and known by the characteristic smell. Mr Mosley also exhibited a pattern of grey calico, which had become discoloured and quite rotten in irregular patches, from mildew; it had lain for some time in a damp place, under pressure; there was this peculiarity ahout it, that the coloured patches, whilst damp, were quite tender, but on exposure to the air and drying, the cloth had recovered its strength.

Mr Heys remarked that twenty years ago he was engaged in the manufacture of fine muslins; it was usual to soak the weft in soap suds to facilitate the weaving; and it was found the cloth was most liable to mildew during hot, close, summer weather, and the greater the quantity of goods heaped together, the more rapidly would mildew set in. The flour from which the size was made was always the best that eould be purchased.

Mr Heys exhibited mounted specimens of the fibres of the Zostera Marina, and stated that, as the fibre is considerably finer than the finest Sea Island cotton, it might probably be of use in the manufacture of fine muslins for ladies' dresses, if possible to obtain a supply, and separate the fibre from the plant by machinery. Mr Heys also exhibited mounted specimens of Queensland cotton, lately sold at five shillings per pound; tbe fibre is very regular in size, and much more cylindrical than other cottons; also several specimens from ripe and unripe pods, and Mr Heys expressed the opinion that great advantage would arise from a regular and careful examination of cotton fibre taken fresh from the plant through every stage of growth.

January 27, 1863.—Mr E. W. Binney said that during the last few years the MS. papers of the late Mr Sturgeon, the electrician, and Professor Eaton Hodgkinson, F.R.S., had been presented to the Society, and were now deposited in its archives. The Council had resolved to collect, as far as possihle, all MSS. by the late illustrious President of the Society, Dr Dalton. He thought that this Society was the most proper depository for the scientific papers or correspondence of any of its deceased members. As it was prohahle that members and other parties might possess papers and correspondence of the late Dr Dalton, he boped that they would be induced to present them to the Society.

Mr Thomas Heelis read a paper "On Swell Observed at Sea, particularly in the Regions of the South-East Trade Wind."

ROYAL SOCIETY.

January 15, 1863.—"Notes of Researches on the Poly-Ammonias: No. XXI. Secondary Products formed in the Manufacture of Aniline," by Dr Hofmann.

"On the Form of Crystals of Peroxide of Benzoyl," by Mr W. H. Miller.

"On the Synthesis of Leucic Acid," by Dr Frankland.

"On the Artificial Formation of Fibrin from Albumen," by Mr A. Smee, jun.

"Note on the Spectrum of Thallium," by Dr W. A. Miller.

January 22, 1863.—"Researehes on some of the Artificial Colouring Matters: I. On the Composition of the Blue Derivatives of the Tertiary Monamines," by Dr Hofmann.

"On some New Compounds obtained by Nitrogen Substitution and Alcohols derived therefrom," by Mr P. Gries.

"On the Differential Equations of Dynamics, a Sequel to a Paper on Simultaneous Differential Equations," by Dr G. Boole.

January 29, 1863.—"On the Absorption of Gases hy Charcoal, No. I.," hy Dr R. A. Smith.

February 5, 1863.—"On the Embryogeny of *Comatula Rosacea* (Link)," by Professor W. Thomson.

INSTITUTION OF CIVIL ENGINEERS.

February 3, 1863.—"On the Woods used for Sleepers on the Madras Railway," by Mr Bryce M'Master, M. Inst. C.E.—The native wood sleepers having hitherto been found for the most part to fail,—on the Madras railway between 30 and 40 per eent. requiring to be renewed annually,—tbe author undertook an investigation with a view of ascertaining the causes of this deterioration, and whether those causes conld he overcome, so as to render available the vast resources of India. Thirteen hundred sleepers, of sixteen different woods, were submitted to careful examiuation and scrutiny twice at an interval of twelve months. The sleepers were variously placed, both on embankments and in cuttings; in some cases they were entirely covered with hallast to a depth of 4 inches, while in others they were as much as possible uncovered, and completely so from the rails to the ends, the ballast being only raised 2 inches in the middle of the way, and sloped off so as to carry away the water under the rails. From these observations, it appeared that only five woods,—Chella Woonjay, Eloopay, Kurrah Murdah, Palay, and Karavalum,—were sound at the end of two years, the other eleven not lasting even that time; also, that when the sleepers were uncovered, decay was less rapid than when tbey were buried in the halast. The plan of leaving the sleepers partially uncovered had many advantages; it effected a saving in the hallast, allowed the defects to be more quickly detected, and kept the sleepers drier. It had been urged, that the heat of the sun would split the sleepers, and cause the keys and trenails to shrink; but from experience, the author was enabled to state, that while amongst the "uncovered" sleepers there was a large proportion "beginning to split," or "useless from being split," there was, on the other hand, amongst the "eovered" sleepers, a still larger proportion "beginning to rot," or "useless from being rotten." It was also noticed, that of the sleepers "beginning to rot," 19 per cent. had commenced under one or both ehairs. This was due to the retention of moisture under them, and might be remedied, the author believed, by tarring the seats of the chairs. As regarded the trenails, wherc the sleepers were rotten, the trenails were invariably found to he in the same state; while when the heads were exposed to the sun, he never found them loosened hy shrinking. Another objection was, that the road would be more liable to buckle and twist, but this was not found to be the case on the 40 miles of line, thus ballasted and opened for traffic, on the division under his charge. Trenails made in India cost £2 10s to £4 per thousand, and the woods generally used for the purpose were Vengay, Kurrah

Murdah, Erool, Porasa or satinwood, and Trincomalee. The three woods first named were also extensively employed for keys, which were considerably larger than usual; but Teak keys seemed to be the best, and their cost did not exceed £6 per thousand. From personal observation and inquiry, the author thought the following woods would make really good sleepers, to be used plain:—Teak, Saul, Sissoo, Bedowk, Kurrah Murdah, Aucha, Vengay, Chella Woonjay, Erool, Karavalum, Dud Eloopay, and Panlay. But as the Indian jungles abounded in woods of too perishable a nature to allow of their being used plain, the author recommended that the sleepers should be creasoted on a much larger scale than had yet been attempted in that country, as those so preserved which had been sent from England answered admirably. The process had not yet been fairly tried in India, as only Saul, Teak, Soondry, Sissoo, and other hard close-grained woods had been submitted to it; while the cheaper, more easily procured, lighter, and more open-grained woods had been neglected. English creasoted sleepers led, say, 100 miles by rail and 50 miles by road, cost 9s 6d each; while good, native wood, plain sleepers delivered at the works averaged 6s each. If establishments and apparatus for creasoting were erected in convenient positions near to each extensive jungle, it was believed sleepers of common wood might be procured for 4s 6d each, and be creasoted for about 1s each.

In proof that the resources of India were likely to be equal to the demand, reference was made to the Report of the Conservator of Forests for the official year 1859-60. From this it appeared that from the Salem Jungle alone—one probably of twenty in the Madras Presidency—about 246,000 sleepers, or sufficient for 133 miles of railway, had been cut during that year. Of this number, about 62 per cent. could not be used plain, and were practically useless, owing to the want of artificial means for preserving those of a perishable nature. But as a supply from each jungle of 2000 sleepers per month would provide for the construction of 500 miles of railway in that Presidency within the next five years, and for a renewal of 33 per cent. of those already laid, it might be confidently anticipated that the supply would not fail, if means were taken to make the naturally perishable sleepers last a reasonable time.

February 10, 1863.—"Description of the Drainage of the Borough of Dundee," by Mr John Fulton.—In designing this drainage, one primary object kept in view was the application of the sewage to some useful purpose, although in the meantime it was allowed to flow directly into the river Tay. Accordingly, the whole drainage, so far as practicable, had been carried to one point—the outlet of a sewer previously constructed by the Harbour Trustees, to intercept the drainage of the town, and prevent it from entering the docks, or tidal basins. This sewer had a fall of 1 in 400, was 7 feet high by 3 feet 9 inches wide, and its discharging end was 8 feet below the level of mean tide. The sewage discharged by it, in dry weather, measured 2 feet in depth, and during storms 6 feet. The velocity in the former case was 65 feet per minute, and in the latter 116 feet per minute. The drainage had been carried out by a combination of brick sewers and salt-glazed, fire-clay socket-pipes, of dimensions suitable for the discharge of the sewage and the flood waters combined. The whole of the brick egg-shaped sewers were provided with invert blocks of glazed fire-clay. The streets drained by tubular sewers were chiefly those at right angles with the river, which were the steepest, and therefore the most suitable for tubular drains. The gases of the sewers were prevented from escaping through the gullies by valves made of stone, and hung with copper links, placed in one side of a small cesspool, the bottom of which was 10 inches below the lower sides of the valves. This form of gully had been found very suitable in Dundee, as the valves freely passed the flood waters, while the cesspools retained all the heavier particles of road detritus. The branch drains had no other trap than the syphon with a cleansing screw, which was placed in immediate contact with the sink, water-closet, or grating used for the reception of soil water, and in such a position as to be easily accessible. No ventilation whatever had been applied to the sewers in Dundee, and none was contemplated; for although a length of 30 miles of main sewers, and nearly as many miles of branch drains, all closely trapped, had been in use for several years, not a single complaint had been made regarding foul emanations from them. The sewers were kept free of all silt, except sand, by the flow of the ordinary sewage and rain-fall, regulated by the flushing gates, so that no putrescent substances were retained in the sewers or drains, to fill them with deleterious gases, and to poison the inhabitants. It was believed it was only where sewers were badly constructed, as regarded their form and water-run, that putrid matters were retained in them, to bring disgrace on the very name of drainage. It was thought that no sewer under 10 feet in height ought to have an invert of more than 9 inches radius, and that a radius of 6 inches was quite large enough for the invert of any ordinary sewer. When the sewage was confined to such a small compass as this, its scouring power was very great; and if care were taken to have the invert blocks laid to a straight line, there would be but little silting, even with a slight fall.

"Description of the Sewerage and Drainage Works at Newport, Monmouthshire," by Mr Alfred Williams, Assoc. Inst. C.E., F.G.S.

February 17, 1863.—Discussion on the papers "Drainage of Dundee," and "Sewerage of Newport, Monmouthshire."

PHOTOGRAPHIC SOCIETY.

February 3, 1863.—"On the Taking of Instantaneous Pictures on Large Plates," by Lieut.-Col. Stuart Wortley.

"On the Theory of the Photographic Processes," by Mr Shadbolt, being a communication from Dr Van Monkhoven.

The Society having determined to award prize medals for the best contributions sent to the Photographic Exhibition, a report from Messrs Durham and Fenton, who had undertaken to act as judges, was read by the Secretary, when the decisions were declared to be as follows:—1. for Portraits, Mr Claudet; 2. for Landscapes, Mr Bedford; 3. for Instantaneous Pictures, Lieut.-Col. Stuart Wortley; 4. for Composition Pictures, Mr P. Robinson; 5. for Copies of Pictures or Reproductions, Mr Thurston Thomson; 6. for best Amateur Contributions, not Instantaneous, Viscountess Hawarden.

Mr England exhibited a simple arrangement of yellow glass for determining its powers of resistance to daylight in operating in the glass-house.

The President addressed the meeting on the present and future prospects of the Society.

GLASGOW ARCHITECTURAL SOCIETY.

February 16, 1863.—"On the Restoration of Ancient Buildings," by Mr Stevenson.

INSTITUTION OF CIVIL ENGINEERS OF IRELAND.

Report of Council.

The meetings have been well attended. Subjoined is the list of Papers read last Session.

Dec. 11, 1862.—Opening Address of the President, Sir R. Griffith, Bart. "On the Conveyance of Light-Draught River Steamers from England to the Volga, with Remarks about the Water Communication in the interior of Russia," by C. H. Moberly, Assistant-Egineer of the Volga Co.—Communicated by W. Anderson.

Jan. 8, 1863.—"On the Physical and Constructive Features of the Madras Railway," by T. H. Going.

Feb. 12, 1863.—"On the Various Forms of Permanent Way, used in Ireland, especially with reference to the Mode of Fastening Joints," by J. Price.

Feb. 12 and March 12, 1863.—"On the Re-construction of the Malahide Viaduct, on the Dublin and Drogheda Railway," by W. Anderson.

April, 9, 1863.—"On the Construction of the Fifty Ton Crane, Dunbar's Dock, Belfast," by G. H. Strype.

May 14, 1863.—"On the Manufacture of Compressed Peat for Fuel, in Ireland," by C. Hodgson, Esq. "On the Action of Sea Water on Lime Mortar," by B. B. Stoney.

Twenty new Members and Associates have been added during the past year—an unusually large number.

The Council have pleasure in laying before the members the first part of Volume VII., containing the Papers read last session. Volume VI. will shortly be published, a delay having arisen in consequence of one of the Papers not being quite ready for publication.

The Treasurer's Account, up to November, 1862, duly audited, was presented.

The Council cannot refrain from noticing, with deep regret, the death of Barry Duncan Gibbons, Esq., an old and valued Member of the Institution.

He held for several years the appointments of Harbour Engineer to the Board of Public Works of Ireland, Resident Engineer of Kingstown Harbour, and Consulting Engineer to the Dublin and Kingstown Railway. A man of sound judgment, great intelligence, and of unblemished reputation during a long and successful professional career. He was born in the South of Ireland, and died at Kingstown, County Dublin, December, 1862.

FOREIGN SCIENCE.

Fluorescence.—M. Dufour has communicated to the French Academy the discovery of Prince Salm-Horstmar, that decoctions of the bark of the *fraxinus excelsior*, or *fraxinus ornus* (that from which the pharmaceutical manna is procured), produce liquids endowed with the most brilliant azure fluorescence, which is rendered most evident and beautiful by electric light.

Embalming and Tanning.—M. Boheuf has published a small 8vo on the pbœnic acid and the saponifiable oils obtainable from coal tar, or that of peat, schist, &c., and from derivatives of which, he points out that liquids of great value for the preservation of animal tissues by embalmment, and by processes analogous to tanning, may be obtained. We believe his methods have been patented in France.

Ventilation.—General Morin has published some interesting remarks upon experiments made by himself at the *Conservatoire des Arts et Metieres*, at Paris, upon the power of ventilation, producible from the waste heat diffused from oil and gas lights. He finds that when the passages of exit are pretty direct and unconfined, 1 kilogramme of colza oil, by its combustion in a moderator lamp, will move 4167 cubic metres of air out of a large apartment, to be replaced by fresh; and that one cubic metre of coal gas should, by reference to the ratio of total heat developed, equally move 2750 cubic metres of air. He comes to the practical conclusion that the waste, and at present injurious, heat of our gas lights, might be made most advantageously available for ventilation.

Vanadium.—A new source of vanadium has been discovered by M. Beauvallet, in the potter's clay of Gentilly, near Paris, and of those of Forges des Eaux, and of Dreux. It is absent in the clays that have been exposed to rain, &c., but in those recently dug, from .001 to .010 parts of vanadium have been found; and Mr Terreil, who has communicated these results to the Institute, remarks that such a diffusion of this hitherto supposed rare metal indicates its being widely spread in nature. We may ourselves remark, that in whatever state the vanadium may thus exist, it is obviously removable by water, and hence it is probable that its existence in some volcanic products is due to its removal from the adjacent rocks by the action of vapour of water.

Beet Root Sugar.—Leplay has presented to the Academy a most important memoir upon beet roots, and of high interest to the agriculturist, in relation to

the variable yield of sugar from different forms and varieties of beet root. The globular roots, which grow on the surface, and are thus most exposed to light and air, appear to be richest in sugar. He has also investigated the yield of sugar from the same root in different soils. Calcareous soils give the highest product in sugar—a fact to rejoice the mind of the Irish cattle feeder. Clay soils, however, differ enormously from each other in their product of sugar from the same sort of root, and the cause has not been accounted for. Carbonic acid gas, obtained by the action of steam on limestone, heated only to a low red heat, has been applied by M. M. Meschelynck and Lionnet to the separation of the crystallizable sugar from the beet root juice with success.

The Perfumes of the Orange Tribe of Plants.—In Sicily and Calabria a plant of the citrus tribe is cultivated under the local name of *Limi di spagna*, and from which, at Squillace, in Calabria, a delicious essence is manufactured, by expression, cold from the rind. The plant is the *citrus lumia*, and is very remarkable, in the difference presented by its fruit, from any of those of the orange or lemon sorts or varieties. The fruit is much like a lemon, but rougher and darker coloured. The juice is not acid, but sweet, and of a peculiarly delicious aromatic flavour, quite different from those of either lemon or orange. The essential oil of the rind has something of the odour of bergamotte, but much more powerful, pungent, and penetrating. It has been recently examined by Signor de Luca; it is, after rectification, limpid and colourless—sp. gr. 0.853 at 18° cent., and its boiling point is 180° cent. It is insoluble in water, though it gives it its odour; feebly soluble in alcohol, and very soluble in ether. De Luca has given its composition C_{20} H_{16}. The *citrus lumia* comprehends many varieties with different odours in its genus. We are not aware that any of them have been introduced into perfumery, at least in England. They would seem well worthy a trial.—Ed.

MONTHLY NOTES.

The auxiliary screw steamer *Calcutta*, belonging to the East India and London Steam Company, has made an unparalleled run of 26 days to Madras, thus performing the whole of the passage in the unprecedentedly short time of 59 days.

Messrs A. & J. Inglis, of Glasgow, have contracted for two steamers for the King of Burmah, to cost something like £13,000 each. His Majesty seems resolved on developing his marine trade, for in addition to these two steamers, which are for river traffic, he intends a sea steamer to ply in the Bay of Bengal.

Messrs William Denny and Brothers, of Dumbarton, have engaged with Messrs A. Lopez & Co., of Alicante, to build for the Spanish Royal Mail Service a duplicate of the large and powerful steamship contracted for about two months ago. These two vessels will be each 2000 tons, with engines of 500 horse-power, and are to be fitted up in every respect in the best style possible. Mr Archibald Denny has also contracted to build a screw steamer intended for the Spanish coasting trade.

The extensive ship-building works, which have been in the possession of Messrs John Scott & Sons, of Greenock, and their predecessors, for upwards of a century, have been purchased by the eminent marine engineering firm of Caird & Co. for £30,000. The premises are exceedingly commodious and convenient. They consist of spacious building slips, a fine tidal basin, and a dry dock, entering from the basin, 300 feet long, with gates 45 feet wide, and an average depth of 15 feet on the sill at ordinary spring tides. The dock is also capable of material extension at small cost. Other buildings comprise the various shops, lofts, stores, &c., with smithies, steam and hydraulic engines, and all other requisities for shipbuilding. It will be pleasant to know that these great premises will be immediately fully occupied, so pressing is the demand for Clyde-built steamers, and so urgent the contracts in the hands of Messrs Caird.

The *Flora*, iron double screw steamer, by Messrs Dudgeon, of Millwall, has lately given rise to some remarks by her performances. She is a vessel of 400 tons, 160 feet long, 22½ feet broad, and 15½ feet deep, and is fitted with two independent engines and screws. Her nominal power being 120 horse. One screw is placed under each quarter in advance of the rudder—a plan which has been tried over and over again. The steam cylinders are 26 in. in diameter, and 21 in. stroke; the screws are 7 feet in diameter, with a pitch of 14½ feet; and she has a pair of tubular boilers working at a pressure of 30 pounds; and an additional high pressure boiler working at 50 pounds. This boiler arrangement seems to be the only real novelty about the vessel. The separate high pressure boiler being added for the double purpose of producing a funnel blast for the furnaces, and for drying the steam from the other two boilers, by a mixture of the high and low pressure. The speed of the *Flora* on the trial was 14·16 knots, with a steady vacuum of 22 inches. The only advantage that we can see in the use of two separate screws, is, as regards turning, and this is of no special importance except as regards war ships requiring to perform smart evolutions. With the screws working in reverse directions, the complete circle was made in about 3½ minutes. On the other side, we have to consider the disadvantages of double screw shafting, and gearing, in fact, double everything.

Iron Floating Dock for Java.—The large dock built at Sourabaya, from the designs of Mr R. W. Thomson, C.E., was successfully floated into deep water on the 23d of November last. The difficulties of launching such an immense structure were evaded by building it in a kind of dam made on the seashore. When the iron dock was completed the sea wall of the dam was broken down, and the sea rushing in lifted the dock from blocks on which it had been built. It was then towed out into deep water. It was intended to commence docking ships for repairs by the end of December last.

Survey of Lochlomond.—Lochlomond, with its varying water levels, has long been the scene of injury and destruction to the ships which float upon its bosom. It is satisfactory to learn that charts of the Government survey of this most interesting of Scottish lakes, have now been prepared, wherein all sunken rocks, shoals, and banks are admirably delineated. Robert Hunter, Esq., Sheriff of the counties of Dumbarton and Bute, at whose instance the survey by Captain Otter, R.N., was made, has also since the preparation of the charts, with the most praiseworthy liberality, subscribed himself, and has induced Sir James Colquhoun, of Luss; Mr Smollet, of Bonhill; Mr Brown, of Balloch; Mr A. Orr Ewing, of Levenbank, the Dumbartonshire and Edinburgh and Glasgow Railways, and the Lochlomond Steamboat Company, likewise to subscribe, for the erection of beacons and buoys on the various sunken rocks, shoals, and banks dangerous to the navigation. These beacons and buoys—which were executed and laid down by Messrs Bell & Campbell, of Bonhill, under the superintendence of Mr Young, the Lochlomond Steamboat Co.'s manager—have now stood the severe gales of this winter in the most satisfactory manner; and as each of the captains of the steamers have been furnished with a copy of the chart, showing all their bearings, configurations, and colours, the public may now consider the navigation of the lake as quite free from danger.

Mulley's Auxiliary Rudder.—About two months since there appeared an account of an experiment tried in Plymouth Sound on a merchant steamer, the *Volunteer*, fitted with Mr Mulley's newly-invented auxiliary rudder. That experiment was so successful that the Lords of the Admiralty shortly afterwards appropriated the screw steam sloop *Cordelia*, 11 guns, of 579 tons and 150-horse power, to the use of the inventor, and she was accordingly fitted with the auxiliary rudder under the port quarter. It consisted of nine bars of American elm 6 inches wide by 4 inches thick, the area being 9 feet long by 4½ feet wide. The auxiliary was made of bars to fall somewhat into the shape of the quarter, and the entire frame was hinged at the fore end, and was opened out aft by gyes worked from the deck when required for use. So equipped, she went into the Sound recently, when a trial took place, under the superintendence of Captain Astley C. Key, C.B., of the guardship of steam reserve Indus; Mr Peake, master builder, Devenport dockyard; and Commander Brown, master attendant, and the inventor. The result was most unexpected. The ship's helm being put hard to starboard, a complete revolution, without the interference of the auxiliary, was made in 6 minutes 26 seconds. The auxiliary, tried alone, was found not in any degree to affect the ship's course; this was attributed, in some measure, to the fact that the *Cordelia* is supplied with a left-handed screw. The helm and the auxiliary being both put to starboard, the circuit occupied 7 minutes 37 seconds, the auxiliary thus retarding instead of assisting the revolution. These experiments were repeated under various conditions, with a uniform result. The quickest revolution (4 minutes 50 seconds) was accomplished when the rudder was placed in opposition to the auxiliary. The longest (7 minutes 37 seconds) was when the auxiliary power was added to the action of the ordinary helm.

Boat-building by Steam.—Mr Nathan Thompson, the American gentleman whose ingenious set of automatic machines for building boats by steam attracted such attention a short time since, has succeeded in grafting his valuable invention upon this country in the form of a limited liability company, which has undertaken to work his patents. The capital of the company is £200,000, only £70,000 of which has been called up to establish the works at East Greenwich, where they occupy a space of 3½ acres of ground with a splendid river frontage, and with room to extend the whole establishment hereafter over 9 acres if required. Here some most spacious sheds and boiler houses have been erected, with 23 machines for making boats, more of which are to be set up, so as to enable the company when in full operation to turn out work at the rate of 25 complete boats per day. The works were recently opened, and a large party of naval and scientific gentlemen were present. On this occasion all the machines were set in motion, and the process of building boats by steam labour shown throughout from first to last. A long and detailed description of these machines has already been given in our columns, so that it is unnecessary further to refer to them here, except to state that their practical working now proves them to realize all the enormous saving as to time and money which Mr Thompson first claimed for them when he came to this country. Thus, by the present hand labour method, to make a line-of-battle ship's launch requires at least from 8 to 10 days, and cost for labour alone, exclusive of material, from £12 to £16. Mr Thompson has proved that by his machinery the same boat can be completed from the rough timber in five hours and a half, and at a cost for labour and machinery of from £1 15s to £2. The combinations of mechanism by which this wonderful saving of time and money is effected, are, in some details, merely a novel application of old principles, though, as a rule, all the chief implements are perfectly new. Even, however, when old principles are used they are made almost new by the wonderful manner in which their sphere of operations is extended, and thus the same steam cutter which levels a lath for the side of a Thames outrigger is capable, by the most trifling alteration of the angle of inclination at which the knives work, to fashion a 50ft. oak plank for the side of a Margate fishing-smack or a 100-ton yacht. Every process of the manufacture was carefully examined and explained, and several boats were ordered to be made for the Admiralty and sent in at once for examination and trial. Already the company have orders in hand to the amount of £22,000, with a certainty of a large increase as the value of the new method of manufacture becomes more generally known. Whether the increased facilities in the way of cheapness and quick manufacture will stimulate the boat consumers to a larger consumption remains to be seen; but, at any rate, the shipping interest generally must be immense gainers by getting very much stronger boats at very much less than half the present prices.

Discovery of Metal.—Professor Ansted was lately reported to have discovered, at St Cuthbert's, in the Mendip Hills, about three miles from Wells, in Somersetshire, a deposit of lead-producing *débris* of old mines and lead-

washings of ancient miners, filling up the bed of a stream that flowed in former ages. This metallic slime, of exceeding richness, was said to amount to 600,000 tons, extending over 25 acres, to the depth of 30 feet, and computed to be worth half a million of money for the lead it contained.—We believe this, however, has not, on further examination, proved to be the fact.

Dye for Wood.—A dyer at Lyons has discovered a method by which wood may be dyed violet. This colour is produced by two immersions—one in iodide of potassium, containing eighty grammes of that ingredient per quart; the other in bichlorine of mercury, at the rate of twenty-five grammes the quart. The wood to be dyed is to be placed in the first bath, where it must remain for some hours. It is then to be immersed in the latter, where it will acquire a bright rose colour. The dyed wood should afterwards be varnished. The baths may be used several times for a similar purpose.

Scottish Iron Trade.—Extracts from Mr Thorburn's annual report :—

Nett Cash Average Price of Mixed Numbers per Ton, Delivered f.o.b. here.

	1845	1846	1847	1848	1849	1850	1851	1852	1853
Average of the Years,	80 3	67 3	65 4	44 4	45 6	44 7	40 1	45 5	61 5
Average Price of Bar Iron in.....	£9 10/	£9 15/	£8 5/	£5 10/	£5 17/6	£5 9/	£5 7/6	£10 10/	£9 7/6

	1854	1855	1856	1857	1858	1859	1860	1861	1862
Average of the Years,	79 9	71 0	72 4	69 2	54 5	51 10	53 6	49 3	52 10
Average Price of Bar Iron in.....	£9 15/	£8 15/	£8 17/6	£8 16/6	£7 10/	£7 7/6	£7 7/6	£7 0/	£6 12/6

Price of Pig Iron in 1810, £9 5s; 1815, £7 15s; 1820, £7; 1825, £11; 1830, £5; 1835, £4 15s; 1840, £3 15s.

Production in 1788, 1500 tons; 1805, 9000 tons; 1820, 20,000 tons; 1825, 29,000 tons; 1839, 197,000 tons; and in 1861, 1,080,000 tons.

Stock on hand, 31st December, 1861, (exclusive of Carron)		535,000 tons.
Stock in Warehouse-keepers' and Makers' Stores, 31st December, 1862, (exclusive of Carron)...	645,000	"
Increase of Stock, ...	110,000	"
Computed make in 1862,...	1,080,000	"
Stock on hand, 31st December, 1861, ...	535,000	"
	1,615,000	"
Exported Foreign and Coastwise from Glasgow, Firth of Forth, Ayrshire Ports, and per Railway, ...	580,000 tons.	
Consumed in Local Foundries and Malleable Iron Works here, ...	390,000 "	
	970,000	"
Stock in Makers' and Warehouse-keepers' Stores, 31st December, 1862, (exclusive of Carron)...	645,000	tons.
Furnaces in Blast, at 31st December, 1862, ...	125	
Furnaces out of Blast, "	50	
Total, ...	175	

Furnaces in Blast. On 31st Dec,		*Make.* tons.	IN	*Shipments and Home Consumption* tons.	IN	*Stock on* tons. 31st Dec.,
1845,	88	475,000	1845	390,000	1845,	160,000 1844
1846,	98	570,000	1846	666,000	1846,	245,000 1845
1847,	100	510,000	1847	579,000	1847,	149,000 1846
1848,	103	580,000	1848	562,000	1848,	80,000 1847
1849,	112	690,000	1849	578,000	1849,	98,000 1848
1850,	105	595,000	1850	535,000	1850,	210,000 1849
1851,	112	760,000	1851	680,000	1851,	270,000 1850
1852,	113	775,000	1852	675,000	1852,	350,000 1851
1853,	114	710,000	1853	950,000	1853,	450,000 1852
1854,	117	770,000	1854	860,000	1854,	210,000 1853
1855,	121	825,000	1855	847,000	1855,	120,000 1854
1856,	128	832,000	1856	842,000	1856,	98,000 1855
1857,	123	915,000	1857	843,000	1857,	88,000 1856
1858,	132	945,000	1858	810,000	1858,	160,000 1857
1859,	125	950,000	1859	915,000	1859,	295,000 1858
1860,	131	1,000,000	1860	903,000	1860,	330,000 1859
1861,	121	1,035,000	1861	927,000	1861,	427,000 1860
1862,	125	1,080,000	1852	960,000	1862,	535,000 1861
						645,000 1862

PRICES CURRENT

OF

CHIEF MATERIALS USED IN STRUCTURES AND MACHINERY.

FOR THE MONTH ENDING FEBRUARY 28, 1863.

(Compiled expressly for the Practical Mechanic's Journal.)

	1st week.			2nd week.			3d week.			4th week		
IRON.	£	s.	d.	£	s	d	£	s.	d.	£	s.	d.
Bars, &c., British, per ton,	6	15	0	7	0	0	7	0	0	7	0	0
Nail Rods,	7	0	0	7	0	0	7	10	0	7	10	0
Hoop,	8	10	0	8	15	0	8	10	0	8	15	0
Sheets,	9	10	0	9	10	0	9	15	0	9	10	0
Pig, No 1, Wales,	4	0	0	3	10	0	3	10	0	3	10	0
Bars, Staffordshire,	7	15	0	7	15	0	7	10	0	7	15	0
Rails,	5	17	6	6	0	0	6	0	0	6	0	0
Pig, No. 1, Clyde,	2	12	6	2	14	0	2	15	0	2	14	6
Swedish in bond,	10	5	0	11	10	0	11	10	0	11	10	0
STEEL.												
Swedish, in kegs,	16	0	0	16	0	0	15	10	0	16	0	0
In faggots,	17	10	0	17	10	0	17	10	0	18	0	0
Spelter, ingot,	17	10	0	17	10	0	17	15	0	18	0	0
Zinc, sheet,	23	10	0	23	10	0	24	10	0	2	10	0
COPPER,												
Sheathing bolts, pr lb.,	0	0	11	0	0	10¼	0	0	10¼	0	0	10½
Bottoms,	0	0	10¾	0	0	11	0	0	11¼	0	0	10¾
Old,	0	0	9	0	0	9	0	0	9	0	0	8¾
Tough Cake, per ton,	93	0	0	92	0	0	92	0	0	92	0	0
Tile,	98	10	0	98	0	0	98	0	0	98	0	0
TIN.												
English blocks, per ton, duty free,	111	0	0	111	0	0	112	0	0	112	0	0
Bars in barrels,	112	0	0	112	0	0	113	0	0	112	0	0
Refined,	116	0	0	116	0	0	117	0	0	116	0	0
Banca, in bond,	115	0	0	115	0	0	116	0	0	115	0	0
Straits, ditto,	114	0	0	113	0	0	113	0	0	114	0	0
TIN PLATES.												
Char. IC, per box,	1	8	0	1	9	0	1	8	6	1	8	6
Coke. IC.	1	2	6	1	3	0	1	4	0	1	4	0
LEAD.												
English pig,	20	10	0	21	0	0	21	10	0	21	0	0
Sheet,	21	10	0	21	10	0	20	15	0	21	15	0
Spanish pig, in bond,	20	0	0	20	10	0	20	10	0	20	10	0
TIMBER—per load.												
Teak,	15	0	0	15	0	0	15	10	0	15	10	0
Quebec, red pine,	3	15	0	3	15	0	3	10	0	3	10	0
" yellow pine,	3	0	0	3	10	0	3	10	0	3	10	0
St. John, N.B., yellow,	5	10	0	5	5	0	5	10	0	5	10	0
Quebec, oak, white,	5	10	0	6	0	0	6	0	0	5	10	0
" Birch,	4	0	0	4	0	0	3	10	0	4	0	0
" Memel,	5	10	0	5	15	0	5	10	0	6	0	0
" Elm,	3	10	0	3	15	0	3	15	0	3	10	0
Dantzic oak,	4	10	0	4	10	0	4	10	0	4	15	0
" Fir,	4	0	0	4	0	0	4	0	0	4	0	0
Memel fir,	3	10	0	3	15	0	4	0	0	4	0	0
Riga,	3	15	0	3	10	0	3	10	0	3	10	0
Swedish,	2	15	0	3	0	0	2	15	0	2	10	0
Deals, per C., 12 feet by 3 by 9 inches.												
Quebec, white spruce,	15	0	0	15	10	0	15	10	0	16	0	0
St. John, white spruce,	15	10	0	15	0	0	16	10	0	16	10	0
Yellow pine, per reduced C.												
Canada, 1st quality,	17	10	0	17	10	0	18	0	0	18	0	0
" 2nd do	12	0	0	12	10	0	12	0	0	12	0	0
Archangel yellow,	14	0	0	14	10	0	14	15	0	15	0	0
St. Petersburgh yellow,	12	10	0	12	10	0	12	10	0	13	0	0
Finland,	9	10	0	9	10	0	9	0	0	9	0	0
Memel,	12	0	0	13	0	0	13	0	0	13	0	0
Gothenburg, yellow,	10	0	0	11	0	0	11	10	0	11	10	0
" white,	9	10	0	9	10	0	10	10	0	10	0	0
Gefle, yellow,	12	0	0	11	10	0	11	0	0	11	0	0
Soderhamn,	11	0	0	11	10	0	11	10	0	11	10	0
Christiania, per C. 12 ft. by 2 by 9 in. yel.	22	0	0	22	10	0	23	0	0	23	0	0
OILS, PAINTS, & DRYSALTERIES.												
Red Lead,	21	10	0	21	10	0	21	10	0	21	10	0
White Lead,	26	10	0	27	0	0	27	0	0	27	0	0
Seal, pale, per 252 gallons,	48	0	0	48	0	0	48	0	0	48	0	0
" yellow,	43	0	0	45	0	0	45	0	0	45	0	0
Sperm,	83	0	0	84	0	0	84	0	0	84	10	0
Cod,	47	10	0	47	0	0	47	0	0	47	10	0
South Sea,	38	0	0	38	0	0	39	0	0	38	10	0
Olive, Gallipoli, per tun,	58	10	0	59	0	0	60	0	0	61	0	0
Palm, per tun,	42	10	0	43	0	0	42	10	0	42	0	0
Cocoa-nut,	51	10	0	51	10	0	52	0	0	52	10	0
Rape pale foreign,	52	0	0	52	0	0	51	10	0	52	0	0
Linseed, per cwt.,	1	18	6	1	19	0	1	19	0	1	19	3
Rough Turpentine, per cwt.,	1	2	0	1	2	0	1	3	0	1	2	0
English spirit without casks,	3	15	0	4	0	0	4	0	0	4	0	0
Hemp Manilla,	34	0	0	33	0	0	34	0	0	35	0	0
Jute,	22	0	0	22	10	0	22	0	0	22	15	0
Hemp Rope,	24	0	0	24	10	0	25	0	0	25	10	0

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to he understood.

10th January, 1863.

85. William Grove, Tenbury—Sawing and cutting wood.
86. William Grove, Tenbury—Sawing wood.
87. Robert Luthy, Thavies Inn—Hydrostatic presses.
88. Maurice Vogl, Sambrook Court—Fastening for bags.
89. L. H. E Lepreux, France—Hygrometric plates —A com.
90. Ferrar Fenton, Mappleton—Pulp for making paper.
91. Edward Powers, Manchester, and J. G. Dale, Warrington—Caustic soda and potash.

12th January, 1863.

92. Dan Dawson, Huddersfield—Magenta colour or dye.
93. E. D. Chattaway, New Broad Street—Railway signals.
94. Ebenezer Stevens, Cheapside—Ovens and cooking apparatus.
95. William Clark, Chancery Lane—Winding or copping frames.—A com.
96. William Clark, Chancery Lane—Carding engines.—A com
97. William Clark, Chancery Lane—Green colouring matter.—A com.
98. A. I. Mahon, Dublin—Propellers.
99. W. E Newton, Chancery Lane—Application of power designed for traction engines, propellers, &c.—A com.

13th January, 1863.

100. T. G. Lewis, Newington Butts—Peramhulators, chairs, and carriages.
101. J. B. Fenby, Worcester—Pianofortes, organs, &c.
102. Thomas Boyle, Gray's Inn Terrace—The comic stereoscope.
103. D. and J. Tannahill, Glasgow—Rivet making machinery
104. William Platts and John Bailey, Manchester—Telegraphic cahles.
105. J. T. Strond, Birmingham—Fixed and portable lights.
106. C. H. Townsend & James Young, Bristol—Preventing incrustation in boilers.
107. R. A. Brooman, Fleet Street—Spindles of spinning machines.—A com.
108. William Southwood, Birmingham—Nails or brads.
109. Matthew Tildesley, Willenhall—Locks and keys.
110. C. E. Amos, Grove, Sonthwark—Manufacture of paper.
111. Lucien Lescnyer, Paris—India-rubher overshoes.
112. Thomas Butler, Nottingham—Lace.
113. J. B. Rock, Pilton, Devon—Saving life and property from fire.
114. Henry Bessemer, Qneen Street Place—Treatment of malleahle iron and steel in furnaces.

14th January, 1863.

115. Joshua Kidd, Cannon Row—Measuring gas.
116. William Pidding, Cole Street—Soles of boots and shoes.
117. J. A. Schlumberger, Switzerland—Colours for dyeing and printing.—A com.
118. J. S. Butler, Nottingham—Bobbin net.
119. G. T. Bousfield, Brixton—Grinding and cntting files.—A com.
120. G A. Biddell, Ipswich—Pulping turnips.
121 Benjamin Burrows, Leicester—Looms.
122. John Lawson, Leeds—Holding castings.
123. Edmund Morewood, Stratford—Coated metallic plates.
124. George Holt, Canterbury Place—Cleaning chimneys.
125. Thomas Wilkinson, Scarborough—Tubular steam boilers.
126. William Johnson, Buchanan Street, Glasgow—Chlorine and bleaching powder, carbonate of soda, soda ash and sulphate of iron.—A com.

15th January, 1863.

127. Henry Turner, Leeds—Preventing disease in potatoes, etc.
128. William Hulse and C. L. Haines, Birmingham—Taper metallic tubes.
129. Edward Howes, Birmingham—Lamps.
130. T. C. Barraclough, Manchester—Cutting metallic tuhes or pipes.—A com.
131. T. C. Barraclough, Manchester—Alarum apparatus.—A com.
132. John Harrop, Manchester—Treatment of organic fecal and urinous matters
133. George Graham, Dalquhurn Turkey-red Dye Works, and John M'Leod, Renton—Turkey-red dyeing.
134 Robert Ferrier, Edinburgh—Wet gas meters.
135. L. P. Josse, Paris—Cleansing grain or seeds.
136. Charles Murrell, Aylsham—Breech-loading fire arms.
137. J. P. Bath, Aigburth—Omnibuses and carriages.
138. C. H. G. Williams, Glasgow—Colouring matters.
139. J. W. Child, Halifax—Spinning and weaving.
140. Alexander Prince, Trafalgar Square—Sewing machines.
141. W. E. Newton, Chancery Lane—Microscopes.—A com.
142. D. F. Leblanc, Percy Street—Level indicator.—A com.
143 R. A. Brooman, Fleet Street—Looms.—A com.

16th January, 1863.

144. John Kerr, Manchester—Stopping railway carriages.
145. Lewis Verdnre, Belginm—Slnbbing frames.
146. J. G. Winter and C. E. Gray, Great Snffolk Street—Vessels for cooling fatty matters.
147. Martin Moeglen, France—Printing colonrs.
148. Edward Loysel, Cannon Street—Preserving property in cases of shipwreck.

17th January, 1863.

149. William Shorrock, Tockholes, Lancaster—Power looms.
150. John Edwards, Basinghall Street—Buttons.
151. John Lightfoot, Accrington—Printing and dyeing fahrics.
152. Isaac Ashe, Birkenhead—Preventing sea sickness.
153. John Combe, Leeds—Carding flax.
154. George Haycraft, Lombard Street—Powder flasks.
155. G. T. Bousfield, Brixton—Hot air engines.—A com.
156. W. E. Newton, Chancery Lane—Buttons —A com.

19th January, 1863.

157. Ephraim Sabel, Moorgate Street—Artificial stone.—A com.
158. Charles Norton, Hawley Road—Roughing horses.
159. John Lanrie, Manchester—Churning milk.
160. Sir W. O'Shanghnessy Brooke, Paris—Insulators.
161. Henry Rushton, Northampton Road—Crinolines.
162. R. A. Brooman, Fleet Street—Sulphate of soda.
163. W. H. Harrison. Haverford-west—Protecting wire and other iron articles.
164. J. J. Lundy, Leith—Metallic casks and vessels.
165. B. Van der Mark, Manchester—Musical instruments.

20th January, 1863.

166 Alfred Paul, Gwennap—Steam engines and pumps.
167. Joseph Mosheimer, Dolgelly—Grinding quartz.
168. John Bell and John Speight, Manchester—Carding engines
169. William Mawson and James Whitehead, Calverley—Hydraulic machinery.
170. H. A. Bonneville, Paris—Clocks.—A com.
171. H. A. Bonneville, Paris—Iron and steel.—A com.
172. Michael Heury, Fleet Street—Retarding railway carriages—A com.
173. William Clark, Chancery Lane—Looms —A com.
174. James Smith, Seaforth, and S. A. Chease, Egremont—Displacement engine.
175. Hesketh Hughes, Homerton, and James Sanders, Nottingham—Trimmings and cap fronts.
176. Samuel Blackwell, Oxford Street—Washing legs of horses.

21st January, 1863.

177. J. W. Meears, Whistlers Court—Sash frames and sashes.
178. Andrew Phillips, Glasgow—Looms.
179. Thomas Wright, Wakefield—Cast iron pipes.—A com.
180. F. A. Busch, Briton Ferry—Metallic vessels.
181. J. M. Kirk, Bradford—Finishing textile fabrics.
182. H. B. Barlow, Manchester—Jacquard machines.—A com.
183. James Holt, Oldham—Willowing and opening cotton.
184. Adolphe Boubee, Paris—Moulding articles in glass.
185. William Clark, Chancery Lane—Photogenic pictures.—A com.
186. William Clark, Chancery Lane—Preserving matters from decay.—A com.
187. Ernest Bazin, France—An improved log.
188. C. H. Roeckner, Richmond Terrace—Paper pulp,
189. Sir C. Lindsay, Grosvenor Square—Railway signals.
190. Albert Pennington, Rectory Villas—Beating mats.
191. Nathaniel Clayton and Joseph Shuttleworth, Lincoln—Rotatory screens.
192. Heinrich Caro and John Dale, Manchester—Colouring matters.
193. Henry Holcroft, France—Separating substances of different specific gravities.

22d January, 1863.

194. William Harrison, Blackburn, and Benjamin Croasdale, Witton—Looms.
195. J. C. Brandes, Paris—Hair creaser.
196. John Grant, Maidstone—Sidings for railways.
197. John Ellacot, Liverpool—Spur wheels, racks, &c.
198. J. M. Binger, Brussels—Printing and typographical rollers.
199. Robert Penney, Carrbrook—Fixing colours.
200. W. and J. Blackwood, Craigton, Dumbarton—Drying yarns.
201. William Clark, Chancery Lane—Piston valves.—A com.
202. Nicholas Wood, Hetton Hall, Durham, and Joseph Stockley, Newcastle-on-Tyne—Grinding and polishing plate glass.
203. Thomas Lambert, Short Street—Drawing off fluids.
204. Charles Lungley, Deptford—Facilitating the repairs of ships.
205. F. W. Morley, Bedford—Boilers and valves.

23d January, 1863.

206. John Milner, Bridge Street—Steam engines.
207. Alexander Henderson, Dundee—Textile materials.
208. Edward Strangman, Waterford, Ireland—Tobacco pipes.
209. Charles Stopford, Bristol—Hats.
210. F. N. Gisborne, Adelaide Place—Ship signals.
211. William Clark, Chancery Lane—Mariners' compasses.—A com.
212. P. A. Cole, Croydon Street—Collars, shirt fronts, habit shirts.
213. Cornelius Turner, Hanslet—Felted fabrics.
214. E. T. Hughes, Chancery Lane—Breech-loading fire arms.—A com.

24th January, 1863.

215. A. O. Glossop, Sheffield—Cruet frames.
216. William Mellor, Ardwick, and William Whaley, Rainow—Steam hammers.
217. William Allen, Cheadle, and William Johnson, Nowton Moor—Pointing cards of carding engines.
218. Ellis Shackleton, Belgium—Looms.
219. E. and G. Booth, Gorton, and Andrew Swallow, Staley Bridge—Fixing colouring mater.
220. M. A. F. Mennons, Paris—Punching and cutting metals.—A com.
221. William Clark, Chancery Lane—Syphons.—A com.
222. A. J. Sax, Paris—Drum skins and gut strings.
223. R. A. Brooman, Fleet Street—Anvils.—A com.
224. Frederick Tolhausen, Paris—Looms.—A com.
225. Frederick Tolhausen, Paris—Carding fihrous materials.—A com.

26th January, 1863.

226. W. F. Stanley, Great Turnstile—Mathematical drawing instrumeuts.
227. J. B. Fell, Sparkbridge, Lancaster—Working railway engines.
228. Andrew Smith, Mauchlin—Staples, locks, bolts, latches.
229. James Fyfe, Greenock—Safety apparatus for steam boilers.
230. A. L. Lietout, and J. B. Roisin, Paris—Gymuastical apparatus.
231. R. A. Brooman, Fleet Street—Crinolines —A com.

27th January, 1863.

232. H. H. Henson. Parliament Street—Fabrics for covering floors.
233. George Davies, Serle Street—Preserving provisions.—A com.
234. W. Gilpin, Newland Street, and J. Hiatt, Rotherfield Street—Umhrellas.
235. C. F. Ash, Upper Thamas Street—Cornices, joints, and laths.
236 Charles Askew, Charles Street—Railway chair and joint.
237. William Rollason, Birmingham—Metallic boxes.
238. R. A. W. Green, Putney—Wager boats.
239. Joseph Edmondson and Thomas Ingram, Bradford—Looms.
240. Thomas Gordon, King Street—Affixing postage stamps.
241 D. E. Hughes, Old Broad Street—Telegraphic communications.
242. W. C. Wilkins, Long Acre—Lamps.

28th January, 1863.

243. H. B. Barlow, Manchester—Preserving timber.—A com.
244. Horatio Watson, Renton—Stoves for drying woven fabrics.
245. Thomas Parkinson, Bury—Carding engines.
246. W. E Gedge, Wellington Street—Boots and shoes.—A com.
247. E. F. Prentiss and J. C. Sellars, Birkenhead—Treating oils.
248. John Oglesby, J., W. M., and J. Dickinson, York—Generating gas.
249. H. O. Cook and E. G. Terrey, Lower Clifton Street—Propelling ships.
250 Charles Mace, Sunderland—Steam engines.
251. Robert Ward, Newcastle-on Tyne—Locking-up type.
252. F. W. Wymer, Newcastle-on-Tyne—Steam engines.
253. James Platt, Charlotto Street—Rotary engines.

254. William Conisbee, Herbert's Buildings—Printing machines.
255. S. W. Francis, Gray's Inn Road—Revolving shutters.
256. William Clark, Chancery Lane—Copying objects of art.
257. J. H. Johnson, Middlesex and Glasgow—Braid.—A com.
258. C. P. Stewart and John Robinson, Manchester—Giffard's injector.
259 E G Muntz, Birmingham—Axles and axle boxes.
260. Henry Crichley, Birmingham—Reaping and mowing machines.—A com.
261. B. J'Anson Bromwich, Charterhouse Square—Motive power

29th January, 1863.

262. H. A. Bonneville, Paris—Granaries.—A com.
263. T. A. Weston, Birmingham—Coupling and break.
264. J. B. E. Louit, France—Glass chimneys.
265. James Mackenzie, Arundel Square—Curvilinear shaping machines.
266. R. A. Brooman, Fleet Street—Candles.—A com.
267. John Pouncy, Dorchester—Printing from photographic pictures.
268. William Ball and John Wilkins, Nottingham—Looped fabrics.
269. Jean Nadal, Brook Street—Fountains.
270. Nathaniel Clayton and Joseph Shuttleworth, Lincoln—Thrashing machines.
271 C. H. G. Williams, Glasgow—Red colouring matter.
272. Arthur Pritchard, Derby—Preserving the contents of packages.
273. Gideon Blake, Trowbridge—Heating and warming.
274. William Clark, Chancery Lane—Coudensation of steam.—A com.
275. John Sainty, Burnham—Feeding troughs for sheep.
276. F. G. Stuber, St. James's Road—Air tight boxes.

30th January, 1863.

277. J. W. Branford, March, Cambridgeshire—Hoeing and cleaning land.
278. W. E. Gedge, Wellington Street—Cleansing chimneys.—A com.
279. W. E. Gedge, Wellington Street—Moulding refined sugar.—A com.
280. James Cocker, Liverpool—Turnstile applicable to omnibuses.
281. N. P. C. Lloyd, Liverpool Street—Atmospheric engines.
282. W. E. Newton, Chancery Lane—Couplings for railways carriages.—A com.
283. W. E. Gedge, Wellington Street—Hair nets.—A com.

31st January, 1863.

284. Mark Smith, Heywood—Looms.
285 John Lightfoot, Accrington, and Frederick Trachsel, Manchester—Distillation
286. Thomas Rennet, Worcester—Taking photographic portraits.
287. John Grossmith, Newgate Street—Producing the aura electric gas.
288 Frederick Tolhausen, Paris—Cleaning mules and spinning frames.—A com.
289. William Drummond, Bank of England—Stopping supply of gas.
290. W. A. Lyttle, Albion Road—Cigars and smoking appliances.
291. E. B. Wilson, Parliament Street—Air, steam, or fluids to furnaces and engines

2d February, 1863.

292. F. G. Grice, West Bromwich—Bolts, rivets, and screw blanks.
293. E. H. Massey, Liverpool—Coating and colouring walls.
294. John Gibson, Halifax—Looms for weaving.
295. Alexander Forbes, Aberdeen—Soldering vessels of tin or tin plate.
296. W. C. Barnes, Enfield—Shaping or compressing metal.
297. R. H. Frith, Dublin—Manufacture of paper.
298. E. B Wilson, Parliament Street—Manufactnre of gas.
299. William Clark, Quadrant Road—Armour plated ships.

3d February, 1863.

300. C. and G. L. Smithies, Manchester—Bleaching fibrous materials.
301. Thomas Raworth, Leicester—Looms for weaving ribbons.
302. George Holcroft, Manchester—Preparing cotton.
303. Samuel Oddy and Edward Oldfield, Salford—Carding engines.
304. Joseph Fletcher, Droylesden, and Henry Bower, Halifax—Injector.
305. A. T. Blakely, Parliament Street, and J. Vavasseur, Southwark—Projectiles.
306. T. L. Jacobs, Burton-on-Trent—Cleaning casks.
307. W. G. Valentin, Oxford Street, and Frederick Levick, Blaina—Generating combustible gases.
308. W E. Newton, Chaucery Lane—Reflectors.—A com.

4th February, 1863.

309. George Harton, Highgate—Wood paving.
310 James Mellor, Manchester—Distilling and drying.
311. T. E Tallent, Bermondsey—Leather.
312 Thomas Bradford, Manchester—Washing, wringing, and mangling.
313. George Haseltine, Chancery Lane—Uniting metallic surfaces.—A com.
314. G. T. Bousfield, Brixton—Postage stamps.—A com.
315. J. J. Hays, Hitchin—Hot air stove.
316. L. J. H. Marville, Paris—Covering for the ears.
317. Z. M Parkes, Upper Park Place—Iron and other metal bond.
318. W. T Weston, Trafalgar Square—Fastening windows.
319. Barnabas Russ, Bristol—Iron ships.
320. C. and D. Faulkner, James Fairley, and W. C. Stiff, Birmingham—Gun barrels.
321. J. A. Manning, Inner Temple—Manure.
322. William Stokes, Edgbaston—Window sashes.

5th February, 1863.

323. W. T. Mabley, Altrincham, and W. T Cheetham, Ashton-under-Lyne—Musical instruments.
324 Joseph Gill, Leeds, and James Parkin, Far Headingley—Polishing yarn, twine, and threads.
325. William Betts, Wharf Road—Metallic capsules.
326. Henry Dircks, Blackheath, and J. H. Pepper, Regent Street—Exhibition of dramatic performance.
327. Edward Ingram, Bradford—Dyeing wool.
328. R A. Brooman, Fleet Street—Spreading wool —A com.
329. John Paterson, Staining Lane—Buckle and hook fastenings.
330. R. A. Brooman, Fleet Street—Tuning pianofortes.—A com.

6th February, 1863.

331 B. F. Bates, Morley's Hotel, Strand—Cannon and projectiles.
332. Alexis Heintzmann and T. A. Rochussen, Friday Street—Gun barrels.—A com.
333. Thomas Blakeley and Benjamin Meakes, Bread Street Hill—Pencil sharpener.
334. Alexander Johnston, Comely Bank, near Edinburgh—Propulsion of vessels.
335 George Stevens, Victoria Terrace—Supply of air or fluids.
336. Alexander Clarke, Staines—Knife-cleaning apparatus.
337. R A. Brooman, Fleet Street—Carding engines.—A com.
338. William Robins, Islington—Fire lighters or faggots.
339. John Price, Southampton—Signal lanterns.
340 R. D. Tivnaun, Wordsley Brass Foundry, Stafford—Boxes for screws to work in.
341. Adolf Ellissen, Warwick Road—Plates of iron for ship building.

7th February, 1863.

342. John Cameron, Barrow-in-furness—Iron and alloys.
343. Jean Siron, France—Medicinal preparation.
344. James Mallison, Bolton-le Moors—Dyeing yarn.
345. George Turner, Rose Terrace—Mincing meat.
346. W. T. Cooper, Tooley Street—Distilling apparatus.
347. Claude Parigot and Antoine Grivel, Paris—Eccentric locks.
348 William Clark, Chancery Lane—Coating wood work and iron ships.—A com.
349. Joshua James, Red Cross Square—Hooped skirts.
350. James Miller, Glasgow, and Wilson Struthers, Hamilton—Securing the corks, stoppers, or lids of bottles, jars, &c.
351. Matthew Hackforth, Bentinck Street—Reflectors
352. George Redrup, Loughborough—Cutting, bungs, corks, &c.
353. David Groucutt, Conley—Iron for making nails.

9th February, 1863.

354 Benjamin Dobson and Edward Barlow, Bolton—Carding engines.—A com.
355. H. G. Williams and Rowland Price, Bonlddu, Merioneth—Crushing quartz, and washing ores.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 18th December, 1862, to 10th February 1863.

Dec.	18,	4530	W Thornhill, 144 New Bond Street—"Anti Garrotting Gravat."
,,	,,	4531	Stephenson, Blake & Co. Sheffield—"Rhomboidal Body for Metal Printing Types of an Italic or other sloping Character."
,,	31,	4532	John Harrison, Birmingham—"An Expanding Travelling Bag."
Jan.	2,	4533	C. E. Penny, London, E.C.—"An Envelope."
,,	21,	4534	D. Davies, Shrewsbury, Salop—"Treble-elliptic Carriage Spring."
,,	27,	4536	C. E. Gray, Borough—"Portable Clothes Drier or Bar."
Feb.	4,	4537	Thomas Woodward, Birmingham—"Improved form of Pistol."
,,	10,	4538	H. W. Hart, Fleet Street, E.C.—"Metallic Monnts for Gas or Lamp Reflectors."
,,	,,	4539	J. A. Forrest & Co., Liverpool—"Improved Ventilator for Dwelling Houses and other Buildings."

TO READERS AND CORRESPONDENTS.

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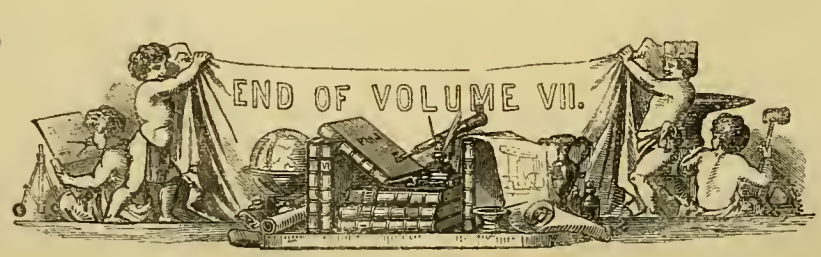

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